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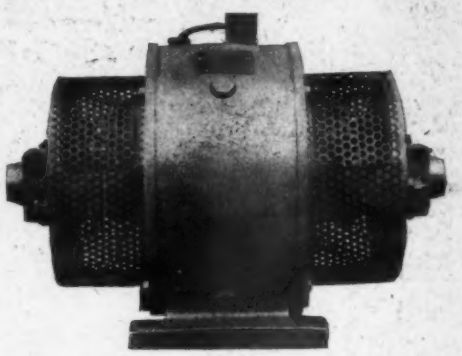

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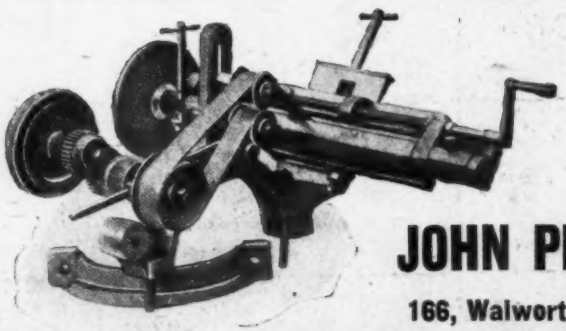

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THE ELECTRICITY SUPPLY BILL.

IN our last issue we printed a rejoinder, from the pen of a well-known authority, to our leaderette on this subject; it reached our hands too late to admit of comment in the same issue. Needless to say, we welcome any sincere expression of opinion, no matter whether it supports our views or controverts them; what we are all seeking is the truth, and the subject under discussion is so exceedingly complex that to arrive at the truth is even more difficult than usual. A false step now may delay the progress of electricity supply for years to come.

With much of our critic's article we are in general agreement; his fundamental aim is "a cheap and abundant supply of electricity"—with the proviso that it really shall be at least as cheap as the existing undertakings can make it. Clearly, however, he holds that the proposals now before the Electricity Commissioners offer no real prospect of producing a cheap supply—that they will, in fact, involve an increase in the cost of energy at the consumer's terminals. That is a question which can only be decided by detailed study of the conditions obtaining in each case, which is one of the main objects of the inquiries that are being held by the Commissioners.

But it is of the first importance to make it clear that our critic's remarks are almost wholly directed to the question of electricity supply in the Metropolitan area, whereas our article, with the exception of a single short paragraph, applied to the whole of the 13 districts delimited provisionally or otherwise by the Commissioners, and this fact should be borne in mind in considering the pros and cons. We have not yet seen "the report of the financial expert on the scheme for the London area," referred to by the author, and therefore must confine our remarks to matter which has been made public in this connection. We have in the first place Mr. Leslie Gordon, hon. secretary of the Conference of Local Authorities, making the following statement to the Executive Committee:—

"Neither from a company point of view nor a local authority point of view is it practicable to call into existence a Joint Electricity Authority as contemplated by the Act of 1919, and as suggested not only by the Conference of Local Authorities, but also by the London County Council, and further by a powerful group of companies supplying electricity within the area in question, without the necessary financial powers. . . . . The practical effect of the scheme, with the powers of the present Bill, will be to stop the wasteful system of producing an inefficient and costly supply in many parts of the area by excessive capital expenditure on existing unsuitable generating stations. The capital cost incurred in carrying out the Conference scheme will be considerably less than the inevitable capital expenditure upon existing stations under the present system to meet the growing demand, while the saving in working costs of administration will be enormous. The risk of any charge falling upon the rates in any part of the area is a very remote contingency."

Mr. Gordon naturally speaks for the local authorities; the engineering scheme put forward by them, however, is identical with that supported by the London companies, and it is *the only scheme* which applies to the whole of the Metropolitan area. It essentially involves the establishment of a Joint Electricity Authority for the district, and that Authority cannot act without the financial powers embodied in the Bill.

It is clear, therefore, that the Bill is, as we stated, essential to the reform of London's electricity supply; and by reform we by no means refer only to the provision of a "cheap and abundant supply," but also to the unification and standardisation of systems and voltages, and all the other improvements which can only be effected by centralising control. To complete that process will admittedly be the work of many years; but is that a reason why we should delay its commencement? Surely the sooner we start, the better.

Failing the Bill, what is the alternative?—To perpetuate the existing chaos, and to make the best of the situation by linking-up the present generating stations and installing new plant in them, where possible. But how far can that process be carried, and how long will it meet the needs of London? From the evidence given at the inquiry regarding the Barking station, and other data, it is clear that the limit will soon be reached—and the steps necessary to meet the future needs of the area should not be delayed. An examination of the reports of London undertakers for the past year shows that the demand is increasing very rapidly; that the heating and cooking loads are developing at a great pace; and that already the difficulty of coping with the position is being increasingly felt. In isolated cases it is true that plant can be installed amply adequate for the local requirements; but that does not solve the main problem. Moreover, all such plant will have to be bought at the same prices as plant for super-stations—and more of it will be required.

Hence, while we await the publication of the report of the financial expert with keen interest, we are not convinced that the Joint Electricity Authority, and therefore the Bill, is not necessary to the welfare of London's electricity supply.

With regard to the two amendments suggested, the first would appear to wreck the whole scheme; to the second, however, we have no objection to offer, and we may remark that the Commissioners, at the Chester and North Wales Inquiry (Elec. Rev., March 4th, 1921, p. 269) definitely and explicitly declared that if after the establishment of a Joint Electricity Authority there was a particular undertaker in the district whose undertaking could be extended at a cheaper rate, and with a greater benefit to the people in the area than the alternative course of taking electricity from some distant supply, they would not refuse to sanction the extension of that station. Hence it is certain that the Commissioners agree in principle with the amendment suggested as, indeed, they are bound to do if they carry out the main purpose of the Act of 1919, to provide a "cheap and abundant supply" of electricity.

The Economic Position of the Engineering Industry.

We conclude in this issue our summary of the pamphlet issued by the Amalgamated Engineering Union in reply to the statement published by the Engineering and the National Employers' Federations, dealing with the present economic position of the engineering and allied industries.

We are publishing fairly lengthy extracts from the reply, feeling that both statements should have a fair share of publicity among the very varied classes of men on both sides who are our regular weekly readers. The parts that we have omitted from the reply are mostly political and polemical.

We found some fault with the employers for not being political enough, and for omitting to lay at the door of the Government a very large share of blame for our present economic position. Their pamphlet was too restrained in its references to Government finance, and almost too severe in its avoidance of anything like political invective.

With the reply under consideration no such fault can be found. It is almost entirely political. The commencing paragraphs are rich in the current phraseology of the politician, sneering a little at the "artist" engaged by the employers to create an atmosphere of artificial gloom. They speak of poison gas and fresh air—hyperbole and analogy of the "mists and mountain tops" type, and quite worthless in considering facts. One may remark that if the employers engaged an artist, the unions employed a poet.

But to come to the subject matter, the first real instalment of reply gives a table comparing engineering exports in 1913 and 1920, and showing a very large increase approaching one hundred per cent. in values in the latter year. The pamphlet omits to point out that the increase is only apparent, owing to the enormously enhanced prices, the actual quantity of goods being lower.

With regard to one of the main causes, certainly the most important, of the present position, viz., the foreign exchanges, the clear and scientific handling of the subject by the employers is treated with contempt. The pamphlet says "The treatise may be disregarded. It is an impudent attempt to create a bogey by mystification." This is no reply, but a deplorable exhibition of carelessness or ignorance with regard to the matter.

The statement that our exchange in the United States being adverse ought, according to the employers, to have produced an opposite result, and to have caused our engineering productions to flow into the United States and elsewhere, is, we fear, a measure of the extent to which the trade unions have grasped the position. It does not seem to have occurred to them that the States do not import machinery at all (except in very special unimportant cases), but produce all they require and much more, the balance being exported.

The pamphlet blames the employers chiefly for supporting a Government which is seeking to impose import duties and to exclude German goods. Now, whatever may be one's views upon Free Trade, it is hardly fair to blame engineering employers for the present policy. The Labour Party, by constantly splitting the opposition vote, at three-cornered by-elections, has probably done much more than all the engineers put together to keep the present Government in power. But this is a deviation into politics pure and simple.

There are further arguments maintaining the importance of a home market supported by high wages, and speaking of a conspiracy to reduce wages, but no attempt is made to show how a reduction of wages is to be avoided. The one obvious remedy which might have been tried, viz., an abandonment of "Ca' Canny" and an increase of output, is not referred to.

An attempt is made to show that the position of the engineering trade is not bad, and a short list of dividend-paying concerns is put forward in proof of prosperity. This, of course, will mislead no one, as the facts are notorious. The reclaiming of Excess Profits Duty is also mentioned, but as this comes to an end before the close of the year, it obviously cannot be relied upon to maintain wages for long.

Without following the authors in their excursions into foreign policy, we venture to ask whether they will now apply themselves to the economic situation, and put forward some definite practicable plan for avoiding the imminent losses with which wage-earners, investors, and employers alike are threatened.

The Lower Severn Deadlock.

The fact that the Organising Committee of the Lower Severn Electricity District has decided that it is not justified in taking further action at present towards the formation of a Joint Electricity Authority opens an interesting question. As this Committee was the only body that was proposing any scheme, it is obvious that nothing further can be looked for in the way of a voluntary proposal. Under Section 5, Clause 2 of the Act of 1919, where it appears to the Electricity Commissioners that the existing organisation of the supply of electricity in a district provisionally delimited can be improved, the Commissioners are required to hold a local inquiry, and under Clause 3 it is provided that if no scheme submitted is approved by the Commissioners, the latter may them-

selves formulate a scheme. Now that the contingency anticipated by this last clause has arrived, it will be interesting to see whether the Commissioners propose to put forward a scheme, or whether the matter will drop. In this case the initiative came from the district itself, since, as will be remembered, there was a proposal locally to form a Joint Electricity Authority within a few weeks of the passing of the Act. Hence the holding of an inquiry did not imply that the Commissioners had decided that the existing organisation stood in need of improvement. However, it is obvious that, under the Act, the next move lies with the Electricity Commissioners. They have no power to impose a scheme of their own upon the district, and we suspect that they will pursue a policy of "masterly inactivity" in that quarter.

The I.E.E. at Home.

The meeting at the Institution of Electrical Engineers last week was worthy of the occasion—the first to be held in the Institution's own building for four years; there was a crowded attendance, and the subject of the lecture was of exceptional interest. Mr. Alfred Johnsen explained the nature of the phenomenon that he, jointly with Mr. Knud Rahbek, discovered in 1917, and the numerous applications which had already been found for it, in the most lucid manner, and the interesting experiments were entirely successful.

We congratulate the Institution upon securing this remarkable demonstration, through the instrumentality of Mr. Ll. B. Atkinson, aided by Mr. Frank Gill, as well as the Danish inventors who gave it. Our "Correspondence" columns to-day show that the phenomenon had been observed in this country as long ago as 1880; but, as Mr. Campbell-Swinton points out, it was discovered and utilised by Mr. Elisha Gray, of Chicago, and in an article by the late Sir W. H. Preece, published in The Telegraphic Journal of September 1st, 1877, it is recorded that Gray's invention was made in 1873. We quote the passage in our "Notes" columns. However, full credit is undoubtedly due to Messrs. Johnsen and Rahbek for, first, rediscovering the phenomenon; secondly, perceiving its importance; and thirdly, turning it to practical use so thoroughly and so quickly.

Penny-Wise.

We cannot imagine that the British Government will permit the Postmaster-General's proposals relating to the increase in charges for overseas circulation of printed matter to be put into force. With a desire to be polite, we might allude to the proposition as short-sighted or mistaken, but if we express our real feelings without restraint, we must describe the plan to put difficulties in the way of the foreign distribution of British trade and technical journals, catalogues, price lists and technical books, as a piece of crass stupidity on the part of somebody, and as one of the biggest blunders committed by the Post Office. What is more important for the well-being of the millions of industrial and commercial workers and their families, than the fullest possible circulation of printed matter prepared in the interest of the foreign trade of the United Kingdom? We have been often warned from Government and other circles that British propaganda abroad is weak and inefficient in comparison with that of rival peoples, and now, when the trade of the nation needs every ounce of help and energy that can be contributed to that end, so that the British Foreign Trade Flag may be kept flying high everywhere, a most unbusinesslike, short-sighted—nay, absolutely stupid—policy is introduced by a Government Department which has no concern with the fact that its penny-wisdom is in effect certain to be a hundred-pound-foolishness. Not only will the Post Office lose in revenue by making the prices of trade literature appear to be prohibitive to the reader abroad, but he will compel firms who dispatch publicity literature thence in pursuit of trade, to cut down their schemes, with a corresponding decrease in resultant business, greater unemployment at home, and less profit to be taxed. We add our voice to the general protest of the industrial community against a proposal which ought on no account to be allowed to go any farther. The bread and butter of the community are at stake. We may make a present of millions sterling to the miners, but we will charge the uttermost farthing to everybody who is so unwise as to try to secure export trade! Tut! Tut!!

Currency.

On May 27th, Mr. E. J. Graves, of Sheffield, gave a lecture at the Institution of Mechanical Engineers on the world's currency system. It was announced by the president that the lecture would be reported in the *Proceedings* of the Institution, and we heartily recommend our readers to look out for it.

The lecturer dealt with the subject exhaustively, and showed how currency systems had grown up and superseded barter, and how, after trials of other standards, we had, to our great advantage, finally selected gold of a standard purity as our standard of currency.

It might be expected that such a subject as currency and the exchanges might be dry and difficult to follow, but Mr. Graves delighted his audience with a most interesting and eloquent discourse. He ended with a moving appreciation of the currency and exchange systems which we have now in existence, and prophesied nothing but evil for any attempt to tamper with them.

While he was thus praising what exists it was impossible to exclude the thought that there is another side to the picture. He did not say that at the present time our gold standard is practically non-existent, and that the foreign exchanges have absolutely broken down, thereby making international trade almost impossible, and reducing whole nations to beggary.

We are inclined to think that something has got to be tampered with soon, if a world catastrophe is to be avoided. The very fact that the value of our currency is gradually rising makes it more and more difficult to sell our goods abroad.

If we may be permitted one more criticism, it is that enough stress was not laid on inflation of credit as distinguished from inflation of currency. The two things are not exactly the same. But the need for public economy was insisted upon most strongly.

A Second Dutch Electricity Commission.

Apparently the final word has yet to be uttered in connection with the question of Government intervention in the electricity supply industry in Holland, for it is announced that a new Government Electricity Supply Commission is to be appointed to give effect to a resolution adopted recently by the Second Chamber of the States General—the so-called Van-Beresteyn-Marchant motion. It was the passing of this resolution which induced the Government to withdraw the Bill creating a semi-public authority to control the generation and transmission of energy throughout the country. In Dutch industrial circles the composition of the new Commission is looked forward to with interest, and the hope is expressed that the Government, in making the nominations, will not repeat the mistake which was made in connection with the former Commission, which was constituted in April, 1919. Although very largely interested in the supply of electricity, the industrial consumers were not even represented on the first Commission; they had no opportunity of expressing their opinions on the proposals made by the Minister of Public Works, and their advice was not officially sought. Not only so, but even the views of the Council of Industry were not heard on the scheme. If these vast interests had been invited to co-operate in reaching a satisfactory solution of the problem, it is considered that the defunct Bill would not have experienced the check to which it was subjected through the resolution adopted by the Second Chamber, and if the new Commission is to be successful in its work, it is submitted that the assistance of the industrial and other large consumers will have to be obtained.

D

THE UNITED ALKALI CO.'S POWER STATION.

A New Mersey-side Station at Widnes.

At the recent general meeting of the shareholders of the United Alkali Co., Ltd., at Liverpool [whose activities cover a wide field, and which owns works at Glasgow, Newcastle-on-Tyne, Widnes, St. Helens, Fleetwood, Bristol, London, in Spain, and America] Mr. Max Muspratt, chairman of the company, recalled the difficulties through which the company had passed, mentioning that during the last six years it had been taxed to no less a sum than £1,759,233, as against a net dividend distribution of £1,847,905, or 9s. 2d. in the £ of the gross amount divided. In addition, on the instructions of the Ministry of Munitions, it had expended just under 2½ millions on new plant. The termination of the war left the company with many arrears of repairs to overtake, and new plant only partly completed, and to have failed to make good the dilapidation and to complete the valuable, but costly, plant would have placed it in a hopelessly inferior position, as compared with its competitors. The gradual development and transference from the old to the newer processes which had been hoped for have not been possible, and as a result of alterations in processes, certain works have had to be permanently closed, while large parts of the Hardshaw Brook, McKechnie, and Hebburn undertakings will not be restarted. Other works, which are at the moment idle, are being kept in commission for the present in case of an early recovery.

That is the dark side, but it must not be assumed that the outlook is all gloomy. The company is optimistic with regard to its prospects and, notwithstanding the present discouraging depression, looks to the future with confidence.

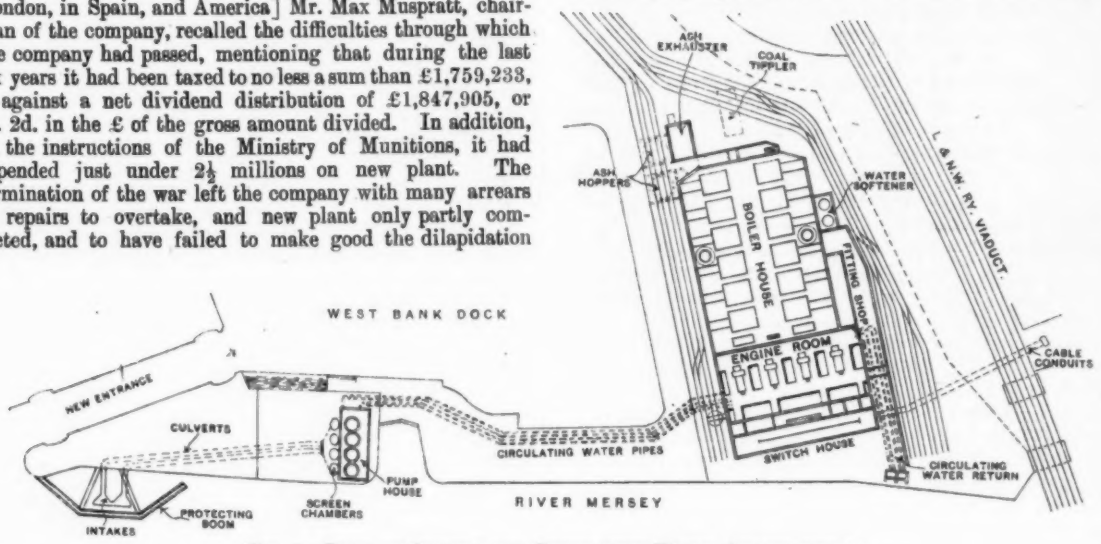

Fig. 1.—Plan of Station and Circulating-Water Arrangements.

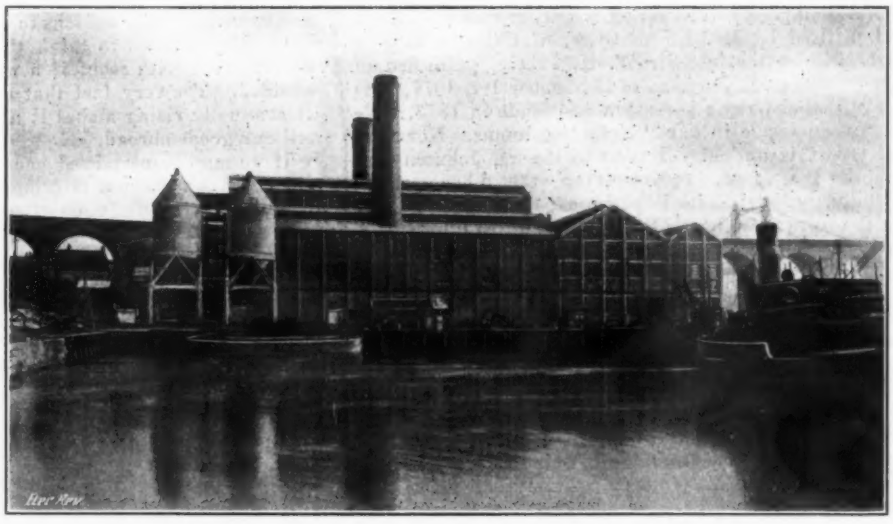

Fig. 2.—West Bank Dock Power Station.

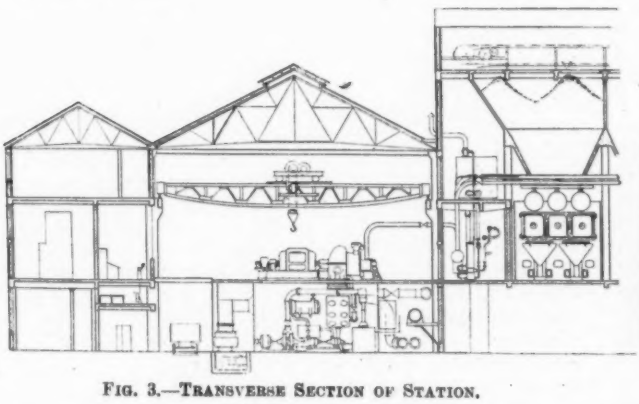

Fig. 3.—Transverse Section of Station.

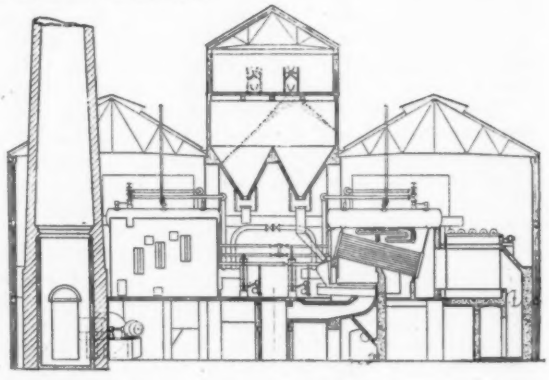

Fig. 4.—Section Through Boiler House.

The overtaking of deferred repairs and the introduction of new processes are practically complete and, in particular,

the electrolytic plant is in perfect order, as is also the new electricity generating station at Widnes. For a century the Leblanc process served the heavy chemical industry of the world, and sentimental regret is felt at the necessary changes; nevertheless, the training that process gave is no small asset. The most important improvement in the company's position during the year was the discovery

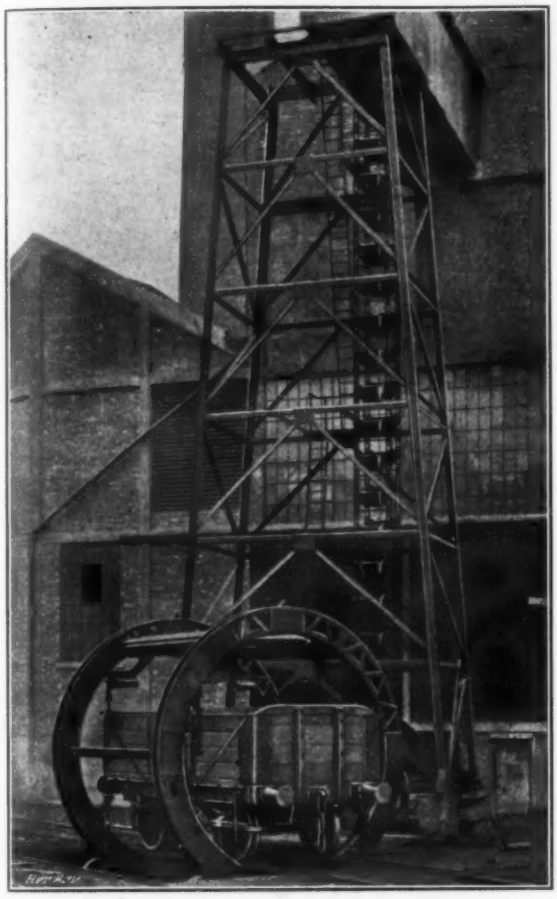

Fig. 5.—Coal Tippler and Elevator.

of brine at Widnes, not of standard quality, but happily well suited for the process the company has installed. Property has been acquired, and borings made, with the result that since the beginning of 1921 the electrolytic plant has been worked practically entirely on brine obtained locally. By the middle of last year the disorganisation due to the war had been overcome, and the efficiency and the work done are showing gratifying improvement. Dr. G. C. Clayton, however, is not yet completely satisfied with the results obtained, and for that reason the works are being equipped with many additional improvements.

One of these is the up-to-date power station, fig. 2, which has been erected on the bank of the river Mersey, between the West Bank Dock and the L. & N.-W. Railway Co.'s bridge which spans the river from Widnes to Runcorn, in order to supply the company's numerous works in and around Widnes with electricity. Although somewhat restricted, the site chosen is a convenient one from the point of view of fuel and ample condensing water supplies, and for the disposal of ashes. The station, which is unique inasmuch as under normal conditions it operates at a load factor of over 90 per cent., at present contains only two 5,000-kW turbo-generator sets and eight boilers, but it is interesting because the existing buildings contain foundations, &c., complete and ready to accommodate additional plant of a larger capacity than that mentioned above; and it would, therefore, be possible for it to augment the existing supply of the district without any serious delay, a fact that should be borne in mind now that the

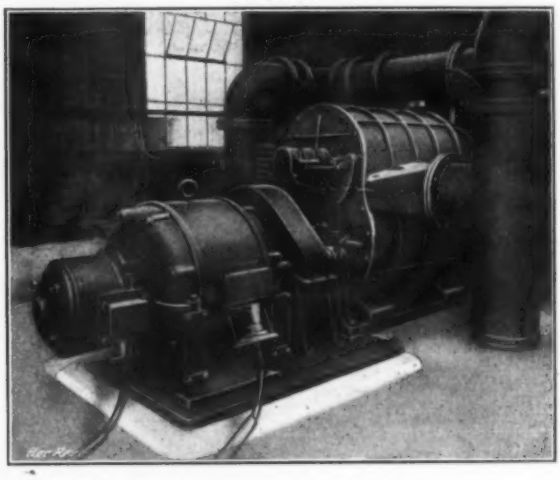

Fig. 6.—Motor-driven Ash Exhauster.

Electricity Commissioners have practically settled the destiny of the Mersey and West Lancashire Electricity District. The station could not, of course, supply Widnes itself on account of the rights of the Mersey Power Co., Ltd., but there should be no difficulty in laying cables to furnish a bulk supply to the Joint Authority when constituted, to the Mersey Power Co., or to other authorised undertakers in the surrounding districts.

The general lay-out of the station is clearly shown by the plan and sectional elevations, figs. 1, 3 and 4; the station buildings include offices, staff and workmen's mess and dressing rooms, stores, and a fitting shop; an electric lift, controlled by push-buttons, and supplied by Messrs. Smith, Major & Stevens, Ltd., serves the various floors, while a 20-ton electric crane spans the turbine room and, as will be seen from fig. 3, a railway line is laid from end to end of the turbine house.

Rock was found near the surface on one side of the station, but on the other it was necessary to pile, and the 16-in. diameter reinforced-concrete piles were cast *in situ* in the following manner:—

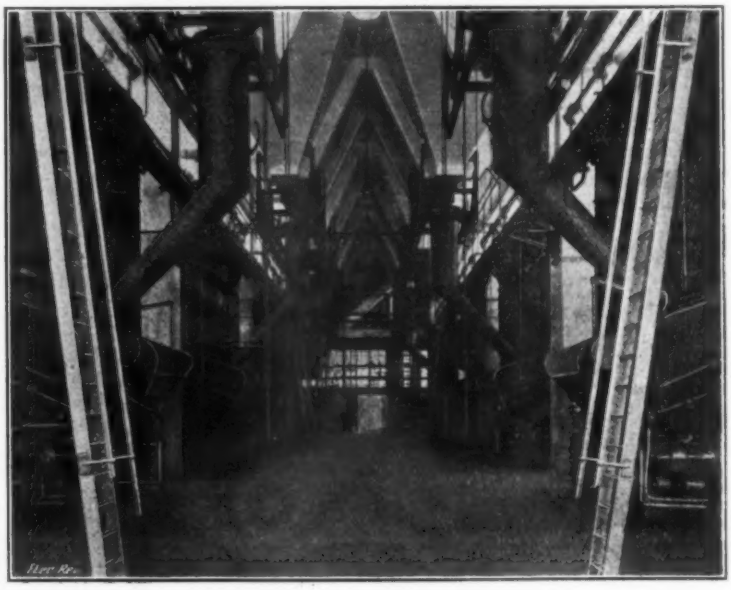

Fig. 7.—Boiler House.

A steel tube was placed on top of a loose cast-iron point, and driven into the ground until the required final set was obtained. Reinforcement was then placed inside the tube where necessary, and the tube was next filled with concrete to a height of several feet (depending on the length of the pile) above the level at which it was desired to finish the head of the pile. The tube was then slowly pulled out of the ground, leaving the loose cast-iron point at the base of the pile, and as the tube was withdrawn the concrete sank and expanded, thus filling up the hole formed by the tube. Some of the piles, reinforced with 1-in. bar down the centre, are 11 ft., and others nearly 30 ft. long, their average length being 20 ft., and the approximate total length of piling 15,000 ft.; 741 piles were driven under the station, or an average of 35 per week. The superstructure, fig. 2, consists of reinforced-concrete columns and beams, and large mass concrete piers, the framework being filled in with brick panels.

The storage and handling of coal is provided for by means of railway sidings. The contents of each wagon is discharged by an automatic tippler, fig. 5, into a hopper feeding an automatic bucket elevator, the latter in turn feeding a conveyor which distributes the coal to overhead reinforced concrete bunkers extending the full length of the boiler house along its centre. The bunkers have a total capacity of 900 tons of fuel, and are covered by the conveyor floor and housing. As will be seen from fig. 7, travelling stokers convey the coal from the bunkers to the furnace hoppers, and in so doing measure the amount of fuel consumed. Incidentally, it may be mentioned that a laboratory is being fitted up, and one boiler set off for the purpose of testing the fuel used. A recent fuel analysis, *i.e.*, January, 1921, gave the following figures:—Calorific value of coal burnt = 8,840 B.th.u.; fixed carbon = 35·25 per cent.; volatile matter = 27·15 per cent.; ash content = 30·18 per cent.; and moisture content = 7·42 per cent.: and the best result obtained under normal conditions of operation, but at an output of only about 3,000 kW, was 2·5 lb. of coal per kWh generated, the fuel consisting chiefly of Lancashire rough slack.

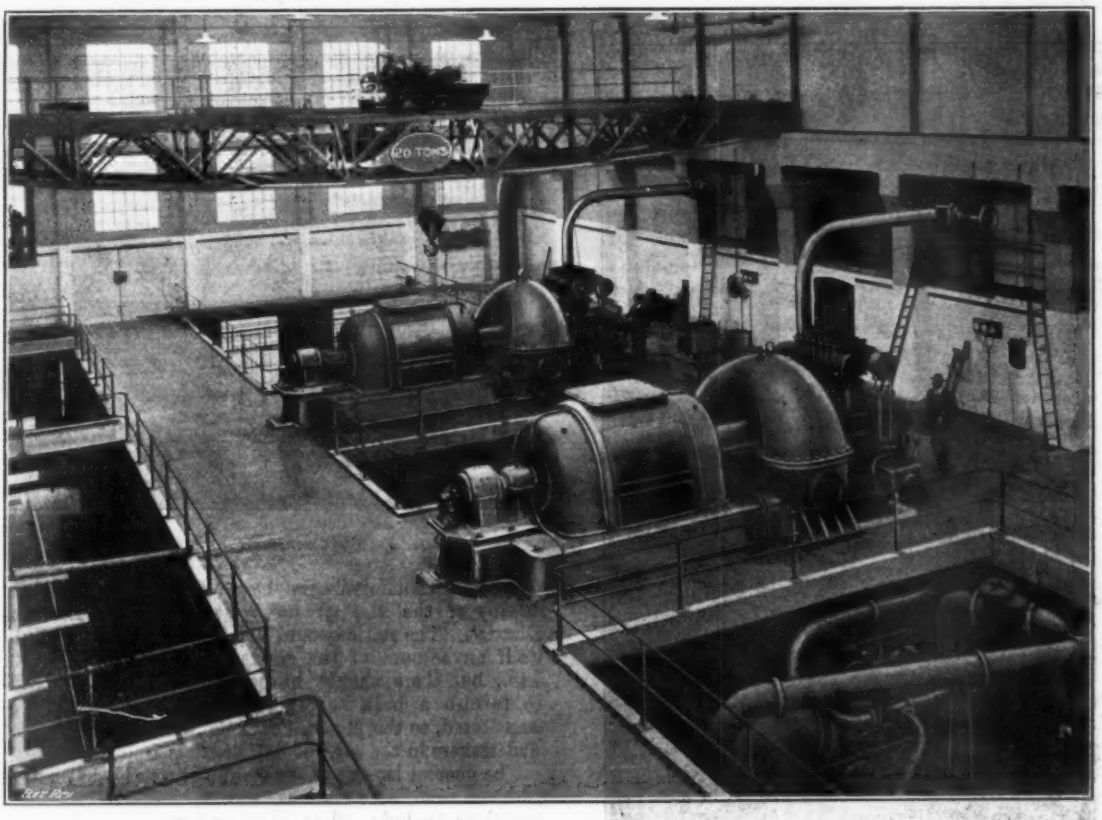

Fig. 8.—Turbo-generator Room.

The boiler house is set at right angles to the turbine room, the firing floor being 14 ft. above the basement level,

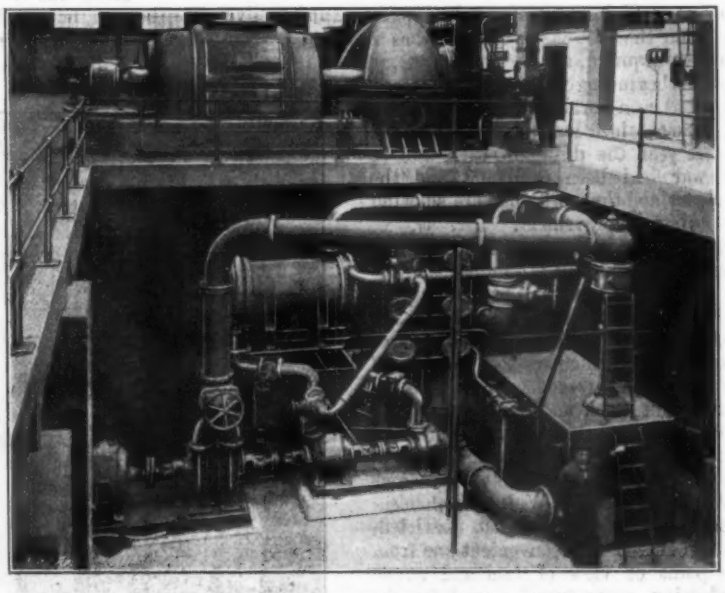

Fig. 9.—Turbo-generator and Condenser Auxiliaries.

and it will ultimately contain 12 boilers which will involve the duplication of the existing coal-handling plant. At present, the building houses eight Babcock & Wilcox water-tube boilers, arranged four on each side; each boiler

has a heating surface of 6,591 sq. ft., and is capable of evaporating 25,000 lb. of water per hour at 220 lb. per sq. in. pressure. An integral superheater having a heating surface of 1,590 sq. ft. adds 200° F. superheat to the steam, and two Underfeed "E" type stokers, with a grate area of 137 sq. ft., are fitted to each boiler, as is also a 200-pipe Green economiser.

An unusual feature of the boiler house is the provision of a warm-air duct extending the full length of the building, which is constructed entirely of reinforced concrete, and through which the air for combustion is forced into the boiler furnaces by means of three (eventually there will be four) sets of fans after it has been drawn through the windings of the main generators in the engine room. Each 35-in. Sirocco fan is driven by means of a 45-h.p. B.T.H. motor, running at 410 r.p.m., and is capable of supplying 44,000 cb. ft. of air per minute at a pressure of 2·75 in. water gauge, or a sufficiency for three boilers burning 12,000 lb. of coal per hour, with a calorific value of 10,500 B.th.u.

Each of the four sets (two to each stack) of 68-h.p. induced-draught fans runs at 360 r.p.m., and is capable of dealing with the products of combustion from three boilers, or a capacity of 94,000 cu. ft. of gas per minute, at a suction of 2 in. water gauge, which is estimated to give a draught of 0·35 in. over the furnace grates, and can be regulated to $\frac{1}{16}$ in. by means of dampers. The waste gases, after passing through the economisers are discharged up two brick chimneys, each 125 ft. high, and having a diameter at the top of 10 ft. Three Weir steam-turbine pumps, each capable of delivering 7,500 gallons of water per hour, or sufficient for three boilers, deal with the feed-water, which is heated (as explained later) and stored in tanks, out of which it is pumped through a second heater, which derives its steam supply from the feed-pump exhaust. The make-up water from the town supply is treated in a softening plant placed outside the boiler house.

For dealing with the furnace ash and the soot from the economisers, Babcock & Wilcox suction equipment is installed in duplicate, each being capable of dealing with 110 tons. Each boiler is fitted with two (one per furnace) concrete ash hoppers, which discharge their contents into a motor-driven crusher that runs on rails from end to end of the basement. The crushed ash is next drawn through pipes (each of the exhausters, fig. 6, is driven by a 74-b.h.p. motor, and maintains a vacuum of from 3 to 6 in. of mercury) into two receivers, shown in fig. 2, and subjected to a spray of cooling water before being emptied into railway wagons. By the use of concrete ash receivers, it is hoped to avoid corrosion troubles which metal receivers are subject to, owing to the presence of moisture and sulphur in the ash.

In the turbine room, two interior views of which are shown in figs. 8 and 9, the generators are placed on a floor 16 ft. above the basement level, and, as previously mentioned, railway trucks can be run right into the basement under the travelling crane. It has been built to ultimately accommodate four generating sets, but the plant at present installed consists of two of the British Thomson-Houston Co.'s 11-stage turbo-alternators, running at a speed of 3,000 r.p.m. Each of the three-phase, 50-cycle generators has an output of 5,000 kW at 0·8 power factor, the generated pressure being 6,600 volts, and the speed of the machines is controlled from the control room by the aid of servo motors. The alternators are totally enclosed and ventilated by fans fitted to the rotors. The cooling air to each is filtered through an "Invincible" wet-air filter made by Messrs. Wm. Grice & Sons, Ltd., in which the air is brought into contact with a large area of static water, on to which the impurities in the air are deposited. At the same time the temperature of the air is reduced to within a few degrees of the prevailing reading of the wet-bulb thermometer.

The turbine steam consumption guarantees when operating with a steam pressure of 200 lb. per sq. in. superheated 200° F., and at a vacuum of 28·5 in. are: 11·8 lb. per kWh at 1½ load, 11·75 lb. at full load, 12·15 lb. at ¾ load, and 12·85 lb. at ½ load. The machines exhaust into Worthington-Simpson three-flow surface condensers, each having a cooling surface of 7,500 sq. ft. Hydraulic vacuum and motor-driven extraction and lift pumps are provided, while the water from the troughs is drained into a tank and conveyed to the feed tanks. The condensate pumps discharge into a Lee recorder which, in turn, delivers the water to a B.T.H. heater that is fed with steam "bled" from the turbines at a pressure of 10 lb. absolute. The heated water is then collected in the boiler feed tanks, as before mentioned. All the condenser and air filter auxiliaries are placed in the basement, as shown in fig. 9, and are readily accessible.

The station is in the fortunate position of having available an ample supply of condensing water from the River Mersey, to deal with which a pump house has been built on a site 200 ft. from the water intake, and 330 ft. from the turbine room, fig. 1. The position of the intake was chosen, so as to ensure an ample supply of water at any state of the river, and at the lowest tide yet experienced the river level remained 18 in. above the intakes. Any difficulties due to silting have been obviated by providing that the rate of flow of water at the intakes shall not exceed the rate of one foot per second, at which velocity there is very little, if any, tendency to pick up sand from the river bed. In the settling chambers the velocity had to be slightly increased

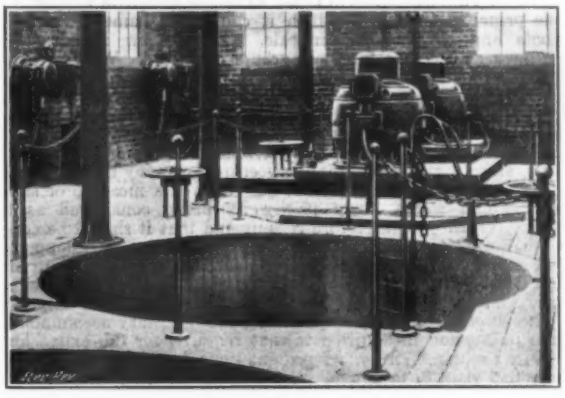

FIG. 10.—CIRCULATING-WATER PUMP HOUSE.

so as to prevent the size and consequently the expense of the conduits becoming too great, but the actual rate of flow was kept under 3 ft. per second, so as to ensure that any sand that was carried in suspension would be deposited in the settling chambers, which can be easily flushed, rather than in the remainder of the pipe line and the condensers wherein the velocity reaches a figure of from 6 to 7·5 feet per second. The two intakes, which are protected by a heavy timber boom, each have an area of 26 sq. ft., and are fitted with vertical 6-in. mesh screens; two reinforced concrete 3-ft. diameter culverts terminate in penstocks at the pump house, where the water passes through ½-in. mesh 30-ft. deep stationary screens, which so far have proved very effective. After being lifted, the water is delivered to the condensers through two 21-in. cast-iron pipes which function by means of siphonic action. On leaving the condensers, the water is returned to the river through two 21-in. cast-iron pipes about 150 ft. long, the ends of which are sealed in wells sunk below the low-water level of the river. A tank, with a capacity of 18,000 gallons of water, is provided for the purpose of flushing the delivery culverts; one culvert is flushed back each day at low tide, and by timing the operation it is possible to keep a check on the rate of silting up.

Four screens and pump chambers have been constructed, but only two pumps are at present installed, fig. 10; they are Rees-Roturbo vertical-spindle centrifugal machines, and are placed 34 ft. down the well. Each pump is capable of lifting 5,800 gallons of water per minute, and is driven by a vertical-shaft, 440-V, 130-b.h.p., three-phase motor, running at 580 r.p.m., supplied by the B.T.H. Co. Two bus-bars and duplicate switchgear are provided, so that the machines can be changed over at will, and the pipe connections are so arranged that either pump can supply either condenser.

(To be concluded.)

REPORT ON THE FUTURE OF BRITISH INDUSTRIES FAIRS.

Last July a Committee was appointed by the Board of Trade to consider the best policy to be adopted in future as regards British Industries Fairs, particularly in respect of the centres at which they should be held, the trades which should be included, and the classes of exhibitors who should be allowed to participate. The Committee, which was presided over by Sir Frank Warner, has submitted its report to the President, but we understand that no decision has yet been taken on its recommendations. The conclusions and recommendations are as follows:—

We are of opinion that, other things being equal, the ideal arrangement would be for the Fair to be concentrated in one centre, and that centre London. We recognise, however, that this expression of opinion may require some qualification in particular cases, and we have given very careful consideration to the question whether the Glasgow and Birmingham Fairs should be continued as part of the British Industries Fair. It appears to us that, in deciding whether either or both of these Fairs should be continued on this basis, the criterion should be whether or not they receive the support of the trades concerned to a degree which would justify their being regarded as national Fairs.

We are of opinion that upon the evidence submitted to us we are not justified in recommending the continuance, of the Glasgow Fair as part of the British Industries Fair. The Glasgow Fair has hitherto failed to secure adequate support in the principal industries which it comprises, namely, textiles, boots and shoes and chemicals, and Glasgow is not well situated as a centre for these groups of trades. We therefore recommend that the trades which have hitherto been included in the schedule of the Glasgow Fair should be transferred to London or to Birmingham, whichever may be most appropriate as regards each particular trade.

Birmingham occupies a more favourable position than Glasgow, since it is the geographical centre for many of the trades included in its schedule, and it has received a measure of support which would fairly justify its being considered as a national fair. We therefore recommend that it should be continued, unless and until it should cease to receive such support. There are also certain practical considerations which point in the same direction. There is considerable scope for expansion at Birmingham, while there would clearly for some time to come be great difficulty in providing the necessary accommodation in London in addition to that required for the expansion of the London Fair on its present lines. The overseas buyer can also visit Birmingham from London at little trouble and expense within the day, and having regard to the bulk and heavy character of many of the Birmingham exhibits there are obvious advantages in exhibiting them at a local centre.

We are not in favour of any new Fairs being initiated in provincial centres as part of the British Industries Fair.

With regard to the question of the trades to be admitted to the British Industries Fair, we are of opinion that the Fair should be open to all branches of British industry desiring to participate. Even in cases where the actual exhibition of the products is impracticable, *e.g.*, heavy machinery, engineering work, &c., the manufacturer may wish to avail himself of the opportunity afforded by the Fair of bringing his products to the notice of overseas visitors, by means of plans, photographs, models, catalogues, &c., and it does not appear proper that in a Fair of this character, organised under Government auspices, any section of British industry should be excluded. The question of the allocation of trades as between the different centres at which the Fair is held is one that we feel can be left to the discretion of the Department to determine in consultation with the respective Fair Committees.

The Fair should continue to be held, as hitherto, at such a time as will enable buyers from overseas to visit it *en route* to Leipzig and Lyons.

We do not consider that, at any rate for the present, sufficient support would be forthcoming to justify the holding of a second Fair in the year.

The Fair should continue in the main to be restricted, as hitherto, to *bona-fide* manufacturers, and to wholesale firms taking the whole output of a factory or holding the sole selling rights of patented or proprietary articles manufactured in the British Empire.

The reasons which have been submitted, in the course of our inquiry, in justification of this policy appear to us heavily to outweigh those urged on the other side. In the first place, we think that special weight should be given in this matter to the views of the manufacturing firms, for whose sake the Fair was originally established, and who have supported it from the beginning. The immense majority of these firms are opposed to the admission of the factor. We believe, too, that the overseas buyer doing business on a large scale prefers dealing with the manufacturer direct, and the success of the Fair in attracting the overseas buyer is probably due in no small measure to the facilities which it affords him in this respect. It is further an advantage to him to know that the product of any particular manufacturer is shown in the Fair on one stand only, and at one price, and that the manufacturer's price. The general admission of the factor would also make it more difficult to ensure that only goods of British origin were included in the Fair. There is also the question of space, which is inadequate to meet existing requirements.

We therefore recommend that as a general rule the Fair should continue as hitherto to be open only to manufacturers and to wholesale firms taking the whole output of a factory or holding the sole selling rights of patented or proprietary articles manufactured in the British Empire.

We consider that this principle should be relaxed as regards textiles, in view of the special conditions existing in that trade, and possibly in the case of other groups of products, if similar conditions can be shown to exist, but we would recommend that exhibits coming under such categories should be shown, if possible, in separate buildings.

A further question to which our attention has been drawn, and which we would venture to emphasise here, is the importance of systematic propaganda. We are aware that the Department of Overseas Trade is fully alive to this aspect of the question, and that an overseas publicity campaign is conducted on an extensive scale in connection with the British Industries Fairs. We consider, however, that the logical development of this policy should involve its extension to all trade fairs and exhibitions held in this country which might afford opportunities for the promotion of export trade, and particularly of course to any which it might be decided to run concurrently with the British Industries Fairs.

LEGAL.

Sentence on Charge of Fraud.

At the Surrey Sessions, held at Kingston recently, two young men from Manchester, who were engaged in business at Surbiton Road, Kingston, named G. E. L. Wynne (22), merchant, and Albert E. Wynne (20), packer, were charged with obtaining credit by means of fraud from the Notable Electric Co., Ltd., of Merton, the Electrical Supplies Co., of London, and others; also for conspiring with G. W. Lester (26), engineer, of the same address, to obtain credit from the Notable Electric Co. by means of fraud. Local reports of the hearing, published in the *Surrey Comet* for May 21st, show that 46 firms were victimised. The matter was gone into in great detail, as there were many transactions. A verdict of guilty was returned against George Wynne and one of not guilty against Albert Wynne. The chairman said the prisoner G. Wynne had been guilty of a series of deliberate frauds, and would be sentenced to 12 months' hard labour on each count, the sentences to run concurrently. Lester failed to surrender to his bail at the last Sessions, and his absence was also reported on this occasion. A warrant for his arrest had been issued, but it had not been possible to execute it. The bail of himself and of his surety was accordingly estreated.

CORRESPONDENCE.

Letters received by us after 5 P.M. *on* Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Charging for Idle Current.

In response to the request, contained in Mr. E. W. Dorey's letter of May 23rd, I give below an example of my method of finding the average power factor, and making a charge for idle current based on it, and on the total units used; the latter bringing in the length of time the low power factor was in operation.

I made a slip in my letter of May 8th in saying "the running charge only should be altered." As will be seen from the example the units are increased in the proportion .8/power factor, so that not the running charge but the amount of units on that charge is altered.

Example.—A 5-ampere meter (one element reversed) in series with a meter of 800/5 amperes, gives the following integration over a certain period:—

800-A meter, 27,980 units.

5-A meter, 108·1 × 800/5 = 17,296,

$$\tan\phi = \sqrt{3}\,\frac{W_1 - W_2}{W_1 + W_2} = \sqrt{3}\,\frac{17\,296}{27{,}980} = 1{\cdot}07,$$

$$\phi = 47^\circ \therefore \cos\phi = {\cdot}682.$$

$$27{,}980 \times {\cdot}8/{\cdot}682 = 32{,}821,$$

or an addition of 4,841 units to the running-charge portion of the account.

Mr. Dorey's method for integrating the kVAh of the reactive and capacity components along with their respective kVA demands is interesting, but I would not care to make out a consumer's account from them, especially if the consumer were fed through several meters when summation dials for all these would become necessary.

J. D. Watson.

Aberdeen.
May 30th, 1921.

The Cost of Living in Burma.

I have pleasure in forwarding herewith particulars of the cost of living in Burma, together with a table showing the estimated average cost under eight different headings.

The cost of living in a boarding house and in a hotel has been included, and it is necessary to consider these costs because free quarters are not always provided, and houses are scarce.

The figures given in the table are below the average for Rangoon and above the average for Burma generally; of course only averages can be given, as the actual cost of living depends so much on the taste of the individual, but these figures may serve as a guide to engineers who may be considering an appointment in this country.

Before accepting any appointment in Burma, I would strongly emphasise the importance of finding out the conditions of living and the social status of the appointment as, unlike conditions at home, there are few, if any, similar electrical appointments in the whole country.

Most companies provide free quarters or a free house partly furnished, and allow one or two other extras, but particulars should also be obtained regarding provident fund, salary, or passage money during leave periods, &c.

By taking all these points into consideration, engineers who may be thinking of coming to the "Silken East" should be able to work out from the accompanying table what their expenses are likely to be.

Item.	Young Bachelor.				Young Married Couple.			
	(a) Sharing free furnished chummery with two others.	(b) Sharing rented chummery with two others.	(c) Boarding house.	(d) Hotel.	(e) Free house partly furnished, &c.	(f) Rented house.	(g) Boarding house.	(h) Hotel.
1. House rent	Nil.	75	230	300	Nil.	250	450	675
2. Food	120	120			240	240		
3. Sodas, wines, &c.	15	15	20	25	20	20	23	28
4. Tobacco, Papers, &c.	10	10	10	10	12	12	12	12
5. Lighting	Nil.	10	Nil.	Nil.	Nil.	25	Nil.	Nil.
6. Guests	20	20	25	30	40	40	50	60
7. Amusements	10	10	10	10	15	15	15	15
8. Club bills	25	25	25	25	30	30	30	30
9. Clothes	60	60	60	60	185	185	185	185
10. Laundry	10	10	10	10	25	25	25	25
11. Furniture, &c.	Nil.	20	Nil.	Nil.	30	60	Nil.	Nil.
12. Car and chauffeur	Nil.	Nil.	Nil.	Nil.	110	110	110	110
13. Gary or motor cycle	30	30	30	30	Nil.	Nil.	Nil.	Nil.
14. Insurance	Nil.	Nil.	Nil.	Nil.	40	40	40	40
15. Servants	50	60	30	35	140	175	40	45
Total in rupees	350	465	470	535	887	1,227	980	1,125
Totals in sterling at present rate of exchange. One rupee = 1s. 3½d....	£22 15 8½	£30 5 5½	£30 11 11½	£34 16 7½	£57 14 11½	£79 17 7½	£63 16 0½	£73 4 10½

In the table I have not included "savings" (a very necessary item), and would point out that unless the salary offered is such that from 20 per cent. to 25 per cent. can be saved, the glamour of the East will soon wear off.

With regard to salary, I would recommend that:—

1. No young bachelor should accept a commencing salary of less than Rs. 500 per mensem, with free furnished quarters, &c., or Rs. 650 per mensem, without free quarters.

2. No married man should accept a commencing salary of less than Rs. 1,000 per mensem, with a free (partly) furnished house, &c., or Rs. 1,275 per mensem, without free house.

3. The agreement should provide for annual increases of Rs. 50 per mensem, with liberal leave allowances.

Before accepting a salary of less than Rs. 1,000 per mensem a young bachelor, hoping to get married, would do well to consult the accompanying table, from which he will understand why some companies when advertising appointments state "Single man preferred."

M.I.E.E., A.M.I.Mech.E., M.Amer.I.E.E., M.I.E. (India).

Rangoon.
May 2nd, 1921.

[By furnishing this valuable and detailed information our correspondent has laid many of our readers under a very real obligation, and on their behalf we offer him our best thanks. —EDS. ELEC. REV.]

Wear of Rotary-Converter Slip Rings.

In your issue of the 20th inst., a correspondent, "Koocaf," reports a bad case of uneven wearing of the collector rings of his 500-kW, 40-cycle, 800-r.p.m., 240-volt, d.c. rotaries. His surmise regarding the transference of metal between the rings and the brushes, while not strictly true, is certainly a shot in the right direction. I shall refer to what is, in my opinion, the real cause later; first, I would hazard the guess that the trouble is greatly accentuated by a too high current density in the a.c. brushes. The amperes per ring, at about 100 per cent. power factor, will approach 1,000; the space available for a.c. brush-gear on a machine of the type considered will usually be quite restricted, and the designer probably was forced to rely on brushes for which satisfactory operation at abnormally high current densities was claimed. Your correspondent, unfortunately, forgot to state how many brushes per ring were employed; he should also have told us the cross-sectional area of a brush.

I would recommend him, however, to satisfy himself that there are sufficient brushes, allowing a current density of about 100 amperes per sq. in. of cross-sectional area. He should also see that they are properly spaced around the rings.

The explanation of the action going on, I hope, will be gathered from the subsequent remarks.

It has been generally recognised for many years that current passing from a brush to a ring in motion will tend to "eat," or burn, away the brush surface, but not affect the ring to any extent; while in passing from the ring to the brush, the former would burn, but not the latter. To form an idea of the action, let us assume the case of a single brush on a ring. The current would then be from the ring to the brush in one part of the ring, representing one pole arc, and would be in the opposite direction in the part representing the next pole arc. Therefore, within a given segment, or part, the current is always in a given direction with respect to the brush and ring. It follows that, in one segment, the ring would tend to burn away, while in the next segment it would not, with the result that there would be as many low spots as there are pairs of poles. Large-section (therefore heavy) brushes would aggravate the trouble, as owing to their high inertia they would not readily follow the slight irregularities first set up, and consequently burning would occur, with rapidly increasing deterioration of the rings. Your correspondent should, therefore, endeavour so to space the brushes that each segment (*i.e.*, the one-sixth part of the circumference of a ring) has at least one brush on it. Owing to mechanical difficulties, this will, no doubt, be impossible, but the idea should be followed as far as possible. For instance, if half the periphery is covered with brushes, care should be taken to have as many brushes on segments corresponding to north, as on those corresponding to south polar arcs.

If it appears hopeless to readjust the present brush gear successfully, "Koocaf" might fit copper-leaf brushes; by working these at 200-250 amperes each, four would be required per ring, two on a north polar arc, and two on a south. The lubrication of the rings would be the same as at present. These brushes, being very flexible, can easily follow slight variations out of true; they have a low contact drop, and probably the rings will operate at a lower temperature.

Undoubtedly, the copper-leaf causes more dust around the rings, and so more attention is necessary to keep them clean; this is their only bad feature, and I know of rotaries fitted as above operating for years with only an occasional "true up."

W. G. Stuart.

Trethomas.
May 23rd, 1921.

Fire Prevention and the Insurance Companies.

Your issue of April 15th contained a communicated article under the heading "Fire Prevention and the Insurance Companies," together with an editorial comment thereon, the theme in both instances being an attack on the attitude of the fire offices committee towards the question of premium rebates to be granted in the case of "protected risks."

It is difficult to believe that the writer of the communicated

article has much experience of insurance business from the actuarial point of view, when he makes the statement that the interests of an insurance company and the interests of the public are in direct conflict. The interests of an insurance company are, first and foremost, to reduce the fire loss ratio, and any sound-principled company prefers to turn its attention to improving the risks under its policies, rather than merely to increasing its annual premium total, regardless of the nature of the risks insured. Are not the public interests equally directed towards improving risks and thereby preventing fires? Although he may be fully insured, the property owner has little comfort as he watches his factory or his warehouse burn down, when he thinks of the interruption which will be caused to his turnover and the loss of business connections which must inevitably ensue.

Under these circumstances the introduction of automatic apparatus for the detection and extinction of fire has received the closest attention from insurance companies, resulting in the granting of a rebate from the insurance premium in accordance with the nature of the automatic device installed, and in this connection your comments are certainly open to criticism when it comes to comparing electric alarm devices with automatic sprinklers.

The writer can speak with more authority than most insurance men on the technical aspect of such devices, having served for a year and a half as a fireman in a large city, and having had actual experience of fires in a large variety of risks. He well knows the value of an early alarm of fire being given, and he also knows what it is to reach the scene of the outbreak and find the *fire already extinguished* in its infancy by the action of the sprinklers. With regard to water damage, it is well known that a fireman entering a burning room which is full of smoke does inevitably cause unnecessary water damage with his fire stream in his endeavours to locate the exact position of the fire, whereas a sprinkler, being operated by heat alone, and not by smoke, confines its water shower to the vicinity of the actual outbreak, and goods stored a few yards distant are untouched by water.

Good as they are, electric alarm devices only make a start in the matter of fire detection, and it is not to be wondered at that insurance companies place on a higher level the apparatus which not only detects but also extinguishes the outbreak. Incidentally, it may not be generally known that in America and Australia sprinkler installations have electrical connections to the fire brigade stations, by means of which an alarm is rung in to the brigade simultaneously with the opening of the first sprinkler by the heat of a fire.

The Royal Commission will, of course, have every opportunity to probe the whole question of fire prevention to its depths, and it will be indeed surprising if the result of these investigations shows the Fire Offices Committee to be as blind as your contributor would have us believe to the pertinent factors in this all-important and national problem.

E. W. Hubbard.

London.
May 27th, 1921.

The Johnsen-Rahbek Electrostatic Loud-speaking Telephone and Relay.

While listening to the brilliant lecture on this subject yesterday at the Institution of Electrical Engineers, and while witnessing the very remarkable and beautiful demonstration with the authors' talking violin, I experienced some dim feeling that I had, in the distant past, read of similar apparatus working on the same principle. I remembered Edison's loud-speaking telephone with its rotating cylinder of moistened chalk, but I also recollected that in that instrument the passage of the electric current had the effect of reducing the friction between the cylinder and the metallic slider rubbing thereon owing to electrolytic decomposition.

This morning, from the perusal of a collection of technical Press cuttings nearly forty years old, I have confirmed my vague impression that Messrs. Johnsen and Rahbek's method, in which electrostatic attraction is employed to increase the friction between sliding surfaces, one of which is of metal and the other of imperfectly conducting material, is not entirely new, as I find that in the late seventies a speaking telephone receiver based on this principle was invented, patented, and constructed by Mr. Elisha Gray, the well-known electrician of Chicago. I have a complete printed account of this instrument, taken, I fancy, from a long-extinct journal of those days called "Design and Work," and find that the instrument is also mentioned in a lecture on telephony given by my old friend Mr. Conrad Cooke before the Royal Society of Arts on May 23rd, 1879. For his badly conducting substance Mr. Elisha Gray used animal tissue, such as bacon rind, pork skin, kid-glove skin, and even the living human hand. A portion of one of these was lightly pressed against a rotating disk of polished metal, and produced sounds and speech from a resonating box owing to the amount of the friction varying with the electrical potential applied through a step-up transformer from a microphone, the effect being due, according to Mr. Gray's own explanation, to electrostatic attraction and repulsion between the sliding surfaces.

Verily "there is nothing new under the sun"; but this revival in an improved and modified form of what would seem to be an old idea appears likely to have several useful present-day applications, while Messrs. Johnsen and Rahbek's experimental demonstration of the surprisingly considerable amounts of force that can in this way be controlled was certainly most convincing.

London. **A. A. Campbell Swinton.**
May 27th, 1921.

[In a letter to *The Times* of Monday last, Mr. Rollo Appleyard points out that in a paper on "Contact with Dielectrics" read before the Physical Society of London in 1905, the phenomenon was described, under the name of "retentive force." The value of the force was measured by a balance at voltages from 0 to 750 volts. Particulars of these and other tests were published in the *Phil. Mag.* in 1894, 1896, 1897, and 1905.

Prof. W. F. Barrett, in a letter to *The Times* of May 31st, went still further back—to January 19th, 1880—on which date he read a paper before the Royal Dublin Society in which he showed that the Edison chalk-cylinder telephone really depended upon the principle which Mr. Appleyard discovered 25 years later—namely, the "stiction" induced when a current passed from a metal spring to a rotating cylinder of chalk or other material. Prof. Barrett described further experiments (showing that an e.m.f. was generated between the metal and the chalk cylinder) in a paper read before the Physical Society of London on March 14th, 1880, which was reported in THE TELEGRAPHIC JOURNAL (now ELECTRICAL REVIEW) of April 1st, 1880, p. 126. A paragraph from this journal of 1877 bearing on Mr. Swinton's letter appears in our "Notes" columns.—EDS. ELEC. REV.]

Coal Shortage and Oil Fuel.

In almost every engineering and daily paper that is read to-day one continually reads of the conversion of some works' boilers from coal to oil burning, because we have placed all our eggs in one basket, and continue to do so.

When are we going to give the internal-combustion engine a real start in life and get some good work and experience from the Diesel engine?

I quite agree that the changes which are taking place to-day are emergency changes to keep works running, but on the other hand, we have had several stations running on Diesel engines for ten years or more, and many are quite satisfactory; surely we should now be in a position to place some reliance in them. I am afraid that people who have not had Diesel experience are allowing them to fall into the same category as the gas engine has had to be content with for many years—simply because of neglect or misunderstanding.

My experience has been that the design, material, and workmanship of gas and Diesel engines are such that, given normal care and attention, you have quite a happy time with them; I have spent many happy years with both types.

In your notes for May 13th the following appears in connection with one installation: "Apart from the advantage that oil fuel is available, while coal supplies are likely to be short for some time, it is claimed that the conversion will result in considerable economies, because:—

1. Consumption is 50 per cent. less than coal.
2. One man can do work requiring six men in the case of coal fuel.
3. Storage is simpler and handling easier.
4. Supplies can be obtained without fear of interruption.

The above four items which have taken seven weeks of strike to bring forward, are well worth considering and comparing individually with what might have been the case had 20 or 30 per cent. of the plant in our medium and small stations been Diesel engines or gas engines, working on a new type of producer where coke can be used efficiently and the tar burnt off at the furnace top.

Take case (1); this seems to point to the fact that we are at last going to be compelled to realise and acknowledge that the days of 3.5 lb. of coal per kWh must be looked on as a wastage of our fuel resources.

If we go a little deeper into the matter, we find that most Diesel engine makers guarantee to produce one kWh for 0.5 lb. crude oil. Now take to-day's figures. One works gives 70 tons of oil to do the work of 100 tons of coal, and the respective prices are £490 and £300. So that oil is at £7 per ton and coal at £3 per ton, while one recent contract in your columns for May 13th showed that the contract had been closed at the average price of 43s. 4d. per ton for all grades of coal.

In your issue of May 27th, Glasgow Corporation quote the coal consumption of their older stations (that is, those which are running to-day with the new Dalmarnock station) to be 3.42 lb. per kWh generated, so that for stations up to 2,000 to 5,000 kW capacity we can safely double this figure and say 7 lb. per kWh generated.

If we take the case of coal at £3 per ton and at 3.42 lb. per kWh generated, we get a fuel cost of 1.097d. per kWh.

Now take oil at £7 per ton and at 0.5 lb. per kWh generated, we get 0.375d. per kWh, or just about one-third the cost.

If we base the price of oil on the coal figure we find we can for the same fuel cost afford to pay a tremendous price for oil. Take the price as above of 43s. 4d. per ton of coal; at the very low figure of 3 lb. per kWh, this gives a fuel cost of 0.69d., and with oil at 0.5 lb. per kWh, we could for the same fuel cost per kWh pay £12.9 per ton of oil. This oil in pre-war days was purchased at £2 per ton when coal was

14s.; the fuel costs then were as follows: Coal 0.225d. and oil 0.105d. per kWh.

There is every reason to believe that these figures will soon return to a pre-war balance. For several years I have plotted the curves for oil prices, and it is known that well over 80 per cent. of the increase is due to freightage charges.

Now, if we take the smaller stations at 7 lb. of coal per kWh generated, and coal at £3 per ton and oil at £7, we get a fuel cost of: Coal=2.247d. and oil at 0.375d., which shows what could be saved by the smaller stations in addition to labour saving and a conservation of our coal; many of our smaller stations would be free from coal strikes, and so leave a bigger margin of good coal for the larger stations where it can be burnt and one kWh produced, as at Dalmarnock, for 1.71 lb., which, after all, is not much to be proud of.

If our medium and smaller stations had installed, say, 30 per cent. of their plant of Diesel or gas engines, they would to-day be carrying on, and giving most of their consumers an adequate supply.

Case (2). One man can attend to several Diesel engines, and so continue the great labour saving that can be shown when we are forced by circumstances to accept something different to the beaten track.

Case (3) follows in each case, and is very noticeable compared with the large floor space occupied by our coal storages.

Case (4) is no less glaring than 1, 2, or 3, and after the many strikes that have occurred of late years, should be well marked.

I consider that many of our to-day extensions to the medium and smaller stations should be in the field of gas and Diesel engines. The electrical industry would then reap a great benefit by putting a cheap supply within the reach of every householder and manufacturer. Where any gas is available it should certainly be used at its maximum efficiency, and then the case of Diesel engines should be very carefully considered for any extensions to run in parallel with the existing plant.

There are many stations in this country where Diesels are installed, and I feel sure that the experience of the engineers of these plants would be very useful.

S. H. Fowles, A.M.I.E.E., A.M.I.Mech.E.

Jarrow-on-Tyne.
May 30th, 1921.

The Grading of Mains Engineers.

I have read with some amusement the letter of "P. S." deriding mains engineers; it is just the same old story over again, each man thinks he has the worst job, but "P. S." will certainly not improve his by trying to belittle others. Personally, I am always glad to see the next man get a substantial increase, because if he can get it, then there is some hope for me. Each post has its own advantages and otherwise. I often envy the "inside" man, because he can walk round the whole of his work in an hour, and when his eight-hour shift is finished, he is free.

Not so the mains man; he must make two or three journeys per day to different sets of men, perhaps miles apart, in all weathers, and when he reaches home he is still at the call of the telephone, and often has to turn out at all hours of the night. I have gone to bed and got up again three times the same night. I have had 25 years of both shift and mains work, so I know a little of each.

Thanks to the E.P.E.A., together with the valued support of the Review, things are improving, and it is up to "P. S." to support the Association, attend the meetings, and ventilate his grievance there, and always remember that criticism, to be of any value, should be helpful, and not destructive.

A. B.

May 28th, 1921.

C.T.S. in Iron Pipes.

I should be glad to learn whether any reader has had any failures of small C.T.S. wires or cables when enclosed in an ungalvanised iron pipe in any situation underground or otherwise, due to the action of rust, and if so, after how many years?

I think the question is of some interest, particularly to wiring contractors, as it is often required to place wires in pipes underground, say, to a garage, and in this position it is well known how rapidly ordinary braided or lead-covered V.I.R. wires fail.

B. W. Gothard.
Electrical Engineer.

Aldershot Electricity Works.
May 26th, 1921.

Submarine Cable Telegraphy.

Regarding the article under above heading in the Electrical Review of May 6th, 13th, and 20th, and with special reference to footnote † concerning paragraph 13 on page 576 (May 6th), may I point out that my surmise as to constant 4 c.h.p.l. having been adopted to cover cable *Morse*, is mistaken?

Constant 4 applies to recorder equal time dot-dash code *only*.

Corresponding constant in Morse work is 5.23 c.h.p.l.

A simple way to utilise, for *Morse*, all formulæ, graphs, tables, and scales included in the above article, is to multiply by 0.57392 all final results obtained therefrom whether for K or for L.

New matter relating to Morse code for cable purposes will soon be submitted for publication.

Edward Raymond-Barker.

London.
May 27th, 1921.

A Peculiar Phenomenon.

We regret that in the interesting letter by Mr. C. R. C. Hadfield in our issue of May 27th, an error occurred in paragraph 6, line 1, "the bluish fluorescence is characteristic of bad and lithium glasses." This should, of course read: "Lead and lithium glasses."—Eds. Elec. Rev.

BUSINESS NOTES.

Bankruptcy Proceedings.—George William Lester, electrical engineer, lately carrying on business at 44-6, Surbiton Road, Kingston-on-Thames, in the name of Lester & Browne.—Under this failure accounts have been lodged at the London Bankruptcy Court showing liabilities £1,904 (unsecured, £1,824) and assets "nil." According to the observations of Mr. F. T. Garton, Official Receiver, a previous failure is recorded against the debtor in May, 1919, when a dividend of 2s. 5d. in the £ was paid under a deed of assignment on liabilities of about £1,000. He further states that, having been previously employed as an electrical engineer, he, with another, entered into partnership, and traded as electrical engineers under the style of Herrtage, Lester & Co., at 4, Queen Street Place, E.C., each finding capital of £25; in or about September, 1917, differences arose, and the partnership was dissolved; the debtor then continued to carry on the business alone, and assumed all the liabilities; in May, 1919, he called a meeting of his creditors and executed a deed of assignment in favour of a trustee, who decided to sell his business as a going concern; the purchaser eventually sold the business to a limited company, the debtor being appointed managing director, at a salary of about £4 per week; he continued in this capacity until about February, 1920, when he resigned. He then, with £25 borrowed capital, resumed business on his own account at 44-46, Surbiton Road, Kingston-on-Thames, as a wholesale electrical engineer, under the style of Lester & Browne; after a few months' trading, owing to lack of capital he transferred his business to a limited company, which only took over the assets, he remaining responsible for the liabilities, the consideration being the payment of £70 in cash and the allotment of 2,505 shares as fully paid, and was appointed managing director, at a salary of £750 per annum. About March, 1920, he opened a branch business at Nottingham, and carried on until about June, 1920, when, owing to its not being successful, he closed it. He had since October, 1920, been without regular occupation. The debtor attributes his present failure to bad trade, extravagance, and losses by betting. The deficiency account showed a net loss of £1,333 on the trading since October 30th, 1919, in spite of which his household, personal, and medical expenditure during the same period amounted to £693, and he lost £117 by betting.

A sitting of the Court was appointed to be held before Mr. Registrar Francke for the public examination of the debtor. The Official Receiver reported that on February 4th the debtor was ordered to file cash and goods accounts, and to attend at the department to give particulars. He had not attempted to comply with that order. Criminal proceedings were pending against the debtor, and it appeared from a newspaper report that he had failed to surrender to his bail under those proceedings. In the absence of the debtor the sitting for his public examination was adjourned *sine die*.

J. F. Lyons, electrical engineer, 27, Palmerston Street, and Front Street, Consett, Durham.—Receiving order made May 20th, on debtor's own petition. First meeting, June 8th; public examination, June 9th; both at Newcastle-on-Tyne.

P. Downie, electrical engineer and factor, 355A, Westborough Road, and 88, Ronald Park Avenue, Southend-on-Sea.—First meeting, June 7th, at 14, Bedford Row, W.C.; public examination, July 6th, at the Shire Hall, Chelmsford.

S. H. Dougherty (Mersey Electric Co.), electrical engineer, Liverpool.—First meeting, June 3rd; public examination, June 27th; both at Liverpool.

R. P. Baker & F. C. Stubbs (Sheffield Electric Construction Co.), electrical engineers, 124, Pond Street, Sheffield.—Receiving order made May 27th, on debtors' own petition.

Company Liquidations.—Ampere Electrical Engineering and Plating Co., Ltd.—Particulars of claims, &c., must be sent to the liquidator, Mr. T. L. Hammond, North-Eastern Bank Chambers, Fowler Street, South Shields, by July 1st.

Sun Fuel Co., Ltd.—A petition for winding up has been presented by Mr. P. J. Mitchell, a creditor, and it is to be heard on June 7th.

Lacy-Hulbert & Co., Ltd.—Winding-up voluntarily for reconstruction. Liquidator, Mr. G. H. Hill, 91, Victoria Street, S.W., who is authorised to consent to the registration and to enter into an agreement with a new company, to be called Lacy-Hulbert and Co. (1921), Ltd. Meeting of creditors called for June 6th, at Boreas Works, Beddington.

Electro-Chemical Developments, Ltd. — A meeting of members is called for July 4th, at Waye, near Ashburton, Devon. Liquidator, Mr. E. A. Ashcroft.

Dissolution of Partnership.—Warwick & Walker, electrical engineers, 107, Church Road, Birkenhead.—Messrs. N. Warwick & A. Walker have dissolved partnership. Debts will be attended to by Mr. A. Walker.

Trade Announcements.—Owing to a recent fire, Messrs. Ames & Co. have temporarily transferred their offices from Market Place to 6, York Chambers, Long Eaton, where all correspondence should be addressed.

The Midland Supply Co. has removed from Paradise Street to larger premises at 53, Summer Row, Birmingham.

Messrs. Marshall & Plumtree, Ltd., of 20, High Holborn, W.C. 1, announce that their telephone number has been altered to "Chancery 7144."

Messrs. Electrical Utilities, Ltd., have appointed Messrs. F. W. Parkes & Co., of 65, Dame Street, Dublin, to represent them in the South of Ireland.

Mr. Dougall, electrical engineer, of 22, South End, Croydon, announces that he is retiring from business.

Mr. F. H. Dennis, electrical engineer, of Chelmsford, has removed his business to the Chelmer Works, 21c, High Street.

Mr. William Raine, who was for 20 years with Sykes & Co., has commenced business as an electrical engineer with his son, trading as William Raine & Co., at 9, Coniscliffe Road, Darlington.

The Mackenzie Holland, and Westinghouse Power Signal Co., Ltd.—This company has removed to 82, York Road, King's Cross, N. 1.

The London Shafting and Pulley Co. has removed to Northdown Works, Northdown Street, King's Cross, N. 1. New Telephone number: "North 196."

Catalogues and Lists.—British Central Electric Co., Ltd., 6 and 8, Rosebery Avenue, E.C. 1.—Monthly List of electrical machinery, including steam turbines, alternators, d.c. generators, and a.c. and d.c. motors.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C. 4.—Publication, No. 173, dealing with numerous examples of the application and working of sheet aluminium. The list is well illustrated, and shows reflectors, distilling apparatus, aeroplane parts, and other articles.

Economic Electric, Ltd., 10, Fitzroy Square, W. 1.—A comprehensive general catalogue of small electrical appliances and apparatus. The list, which is fully illustrated and priced, includes small motors and dynamos, telephone instruments, electric bells, pocket lamps, dry cells and accumulators, spark coils, X-ray tubes, &c.

Messrs. Parmiter, Hope & Sugden, Hulme Electrical Works, Manchester.—A splendidly produced catalogue of "Fluvent" and "Ajax" electrical switchgear. Full prices and illustrations are given of magnetic blowouts, ironclad three-phase and double-pole fuse boxes, coupled boards, crane control panels, inspection troughs and sealing boxes, switch fuses, unit type switchboards of many types, mining type switchgear, and the "Rotaloc" fuse system.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C. 2.—Booklet No. V 2,532, giving illustrations and prices of a wide variety of "Freezor" fans for a.c. or d.c., wall, ceiling or table. Also automatic shutters and regulators for fans.

The Lawton Machine Tool Co., Burgess Street, Sheffield.—An illustrated leaflet, giving details and prices of "Lawton" simplex oil burners.

X-Rays, Ltd., 11, Torrington Place, Gower Street, W.C. 1.—An illustrated pamphlet describing the "Ped-o-Scope," a device for use in shoe-fitting.

Langham Engineering Co., Park Street, Slough, Bucks.—A list giving details and illustrations of "Langham" d.c. motors and dynamos. Fully priced.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Leaflet No. 881, a pamphlet illustrating a number of interchangeable lighting fittings for building up into various styles.

The Cambridge and Paul Instrument Co., Ltd., 45, Grosvenor Place, S.W. 1.—A postcard advertising List No. 191, dealing with "Cambridge" potentiometers, &c.

Messrs. Studebaker, Ltd., 117-123, Great Portland Street, W. 1.—A priced booklet, illustrated in colour, describing the "Lalley Light" house-lighting plant and its advantages.

Messrs. E. P. Allam & Co., 107-109, Gray's Inn Road, W.C. 1.—Monthly Stock List of d.c. motors for sale and hire—June, 1921.

Messrs. Henry Wallwork & Co. (1920), Ltd., Roger Street, Manchester.—Two well-produced booklets, illustrated and fully detailed dealing respectively with gear generators and worm gear devices (including several applications to electrical machinery). Also a number of leaflets giving further details and prices.

Mr. E. W. Dorey, Norwich House, Southampton Street, High Holborn, W.C. 1.—An illustrated pamphlet dealing with the improvement of power factor by means of static condensers.

Messrs. Leopard Bros., 81, Micheldever Road, Lee, S.E. 2.—An illustrated and priced leaflet dealing with a new bonding and earthing clip for wiring systems.

Messrs. Higgs Bros., Sand Pits, Birmingham.—"Monthly Magazine," June. Prices and particulars of a.c. motors and d.c. dynamos and motors, hints on power required for machine tools, and the usual features are included in this issue.

The Electric Heating Co., George Street, Croydon.—An illustrated and priced pamphlet advertising electric kettles and the "Elect" electrical irons for domestic and tailors' use.

Catalogues Wanted.—Messrs. Aldrich & Butland, who have commenced business as electrical and mechanical engineers at Castle Street, Ruthin, desire to receive catalogues from manufacturers, &c.

Safeguarding our Industries.—The House of Commons, on Tuesday, renewed its discussion of the financial resolutions relating to the Safeguarding of Industries Bill. An amendment was moved reducing from five to three years the period of the import duty of 33⅓ per cent. on certain imported articles, but it was lost by 203 to 81 votes. An amendment to substitute 10 per cent. for 33⅓ per cent. was defeated by 244 to 79. A further amendment to omit optical glass, &c., because the industry did not require assistance, was lost by 209 to 70, and one to omit arc-lamp carbons from the resolution was rejected by 168 to 75. Other amendments met similar fates, and ultimately the first resolution was put as a whole and carried by 194 to 74. The discussion was then turned on to the second resolution, which imposes the Customs Duty of 33⅓ per cent. to prevent dumping, and an amendment was moved to limit the operation of the resolution to one year.

The Coal Dispute.—Neither side having given way in matters of principle affecting the future conduct of the coal-mining industry, the dispute continues.

The bulk of public service undertakings are carrying on with surprising vigour after eight weeks of stoppage, and oil fuel is gradually being introduced to more and more power stations.

Further developments in connection with the staff of the L.C.C.'s Greenwich station are foreshadowed by the *Daily Herald*. The trouble arose from the dismissal of members of Trade Unions for carrying out the instructions of the Transport Workers' Federation with regard to the handling of imported coal. The withdrawal of the "embargo," it having proved ineffective, led to a request for the re-instatement of the men whose position was not to be prejudiced by their action. This has apparently been refused, and a meeting of representatives of the Unions involved was to be held on Wednesday night, when further action was to be discussed.

The official unemployment figures for the week ended May 30th, quoted by the *Morning Post*, showed a further increase, bringing the total up to 2,070,100, in addition to those working shorter hours.

Norwegian General Strike.—The *Morning Post* correspondent at Christiania reported on May 27th that owing to the general strike, Christiania was without tramcars and gas, although the electricity supply was being maintained. The railways and hospitals were not affected by the strike.

A later message stated that the principal electric cable in the centre of the city had been cut, depriving this district of light.

Additional G.E.R. Trains.—The Great Eastern Railway Co. has for some time past been using liquid fuel for locomotives, the apparatus used being what is known as the Holden injector, and with recent additions it now has a total of about 50 engines so fitted. These engines can without further alteration consume either solid or liquid fuel, as may be necessitated by circumstances. This, in conjunction with the use of wood and coke, will enable the company to extend its present limited services.—*Financial Times.*

Electrical Trade in Italy.—Our attention has been called to the fact that the figures in the Italian article, page 651 (May 20th) are incorrect. The cwt. there referred to are to be understood as quintals—*metric* quintals—and not the common quintals, which only are equivalent to cwt. The Italian paper from which the article was extracted did not specify that the quintals in question were metric ones. Hence, from a lapse of attention, the mistake of the translator.

Visit of American Trade Delegates.—The American and Canadian Trade Delegation at present touring this country visited Preston, on May 26th, and inspected various large works, including those of the English Electric Co. (Messrs. Dick, Kerr's) and the Leyland Motor Co.

Outing.—The ladies of the Ediswan Ponders End staff went for a very successful outing on Saturday, 21st ult. A party of nearly 100 left the works in three large charabancs for Ruislip Common, where various games, sports, &c., were engaged in until tea-time. After tea the journey was continued to Uxbridge, where a dinner was held at the Chequers Hotel, under the chairmanship of Mr. J. W. Elliott. After dinner there was a short concert, organised by Mr. A. P. Ambler. A hearty vote of thanks was given to the Ladies' Organising Committee.

The Cost of Living in Constantinople.—In the *Journal* of the British Chamber of Commerce, p. 164, is given a detailed table from official sources showing the cost of living in Constantinople during the past six months, as compared with July, 1914. Since November last there has been a downward tendency, but the cost in April was still 1,230 per cent. above the cost in July, 1914. The rate of exchange (piastres) was 568.

The Belgian Thomson-Houston & Carels Co.—The directors of the Société d'Electricité et de Mécanique (Procédés Thomson-Houston & Carels), reporting on the year 1920, state that the period was one of transformation and preparation, particularly with regard to the production of electrical plant. As was mentioned in the report for 1919, the company had just begun the delivery of electric motors made in their own shops, and in July, 1920, the production of these motors in bulk reached the figures which had been decided upon previously. To this branch was subsequently added the construction of rheostats, and towards the close of the year that of large motors and transformers. These productions had now become normal, and the construction of large alternators and of certain apparatus has recently been commenced. As to the output of Diesel engines and of steam engines, it had been possible during the year to give these departments the same importance as they had in pre-war times, and the company had resumed the position which the Usines Carels had been able to obtain in foreign markets, where most of the production was disposed of; and it is added that 92 per cent. of the orders yet to be invoiced in 1921 are for foreign account. After recalling the advantages accruing to the company from the agreement concluded with the International General Electric Co., of Schenectady, the report mentions that one of the results of the arrangements made was that the company had obtained control over the patents for the manufacture of incandescent electric lamps in Belgium, and was now engaged in establishing this branch of manufacture. For this purpose the company had acquired an interest in the Manufacture Belge de Lampes Electriques, which was to be assisted in improving and developing its production. While waiting until the company's own works at Ghent was able economically to undertake the construction of new classes of electrical plant, the company's sale organisations were using the plant made by associated companies, and were thus securing customers for the company's own products. On the other hand, the company had already supplied to allied companies some electrical plant made at Ghent, and several thousands of motors were being built for the account of the International General Electric Co., which the latter would subsequently distribute throughout the world. The financial results were very satisfactory, the net profits having been 2,722,000 fr., and permitting of the payment of a dividend at the rate of 8 per cent.

British Handicapped in Dutch Market.—Critical times have been passing in Holland since the attention of electrical engineers in the United Kingdom was attracted some time after the armistice to the ambitious schemes for the electrification of that country.

Dutch industries, which at the beginning of last year were flourishing, owing to the world's demand for goods, have naturally felt the sudden and general decrease in trade. Complaints of competition of goods produced with cheaper labour in Germany have called a movement into existence in Holland, as in several other countries, to legislate against dumping. Stocks of raw material have had to be sold at a loss, and difficulty has been experienced in disposing of manufactured goods. Banks have discouraged credit operations.

Probably for these and similar reasons the far-reaching plans for supplying electricity to farm, factory, and railway throughout Holland have faded somewhat into the background. Apparently they have been postponed or are likely only to be carried into effect in a less elaborate form.

The report on Netherlands industries by H.M. Commercial Secretary at The Hague, which has recently been issued by the Department of Overseas Trade, states that in the opinion of some leading Dutch financiers, it is expected that the present depression, both in industrial and financial circles, can be tided over without serious failures. This view is confirmed by the present general trend of the money market. Bankruptcies, although more numerous than this time last year, have not been spectacular either in number or in importance.

Readers of the Electrical Review will recall that a Bill—based on the report brought out by the Advisory Committee formed in April, 1919—regarding the supply of electricity in the Netherlands was introduced in July, 1920.

Whether the electrification plans are executed wholly or only in part, British electrical manufacturers, particularly of cables, should keep in touch with the business, though unfortunately every month's delay is likely to intensify the strength of German competition. H.M. Commercial Secretary takes the view that unless there is a modification in the present disparity in prices, no British competition in Holland will be possible.

Rough percentages are given below of the share of the more important importing countries in the Dutch electrical trade for the first eleven months of 1920:—

Insulated cable and wires, Germany, 60 per cent.
Insulated cable and wires, United Kingdom, 30 per cent.
Electric motors and transformers, Germany, 50 per cent.
Electric motors and transformers, Switzerland, 17½ per cent.
Electrical instruments, Germany, 70 per cent.
Internal combustion engines, Germany, 50 per cent.
Internal combustion engines, Sweden, 20 per cent.
Boilers, Germany, 60 per cent.
Machinery (exclusive of textile machinery), Germany, 70 per cent.

Yet the fact cannot be sufficiently emphasised that neutral ground like the Dutch market should be treated with great consideration if British industries are to prove themselves willing to compete abroad, and not remain conservatively engaged in production for overseas Dominions and Colonies only.

How German trade is helped by the depressed value of the mark is well known, and H.M. Commercial Secretary reports the ingenious manner in which German exports to Holland are stimulated by the artificial maintenance of this condition of affairs. It appears that whenever signs of an improvement in the exchange are evident, an influx of marks is arranged. With the florins thereby obtained, dollars are purchased. This results in a two-fold benefit to Germany, viz., the continued depression in the mark exchange in the Netherlands and a supply of dollars for the purchase of raw material. Where all quotations for export to the Netherlands are in florins, the depression of the mark abroad is of no interest to the exporter, as its purchasing value will always remain much higher in Germany than abroad.

Repeated evidence has been obtained that purchasers in the Netherlands are interested in British goods, and this interest, he says, should not be damped at the outset by the impossibility of comparing prices when these prices differ, not by small percentages, but by nearly one-half, as was the case in a certain contract for the supply of locomotives for the Dutch East Indies. The soundness of the Commercial Secretary's advice is unquestionable, but it is difficult to see how in present circumstances it can be acted upon.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

London.—July 4th to 15th, London Fair and Market; September 7th to 28th, Shipping, Engineering and Machinery Exhibition; September and October, Textile Industries Exhibition; October 14th to 22nd, Commercial Motor Exhibition; November 4th to 12th, Passenger Motor Exhibition; November 17th to 25th, Public Works, Roads and Transport Exhibition; 1923, British Empire Exhibition.
Cardiff.—1922, Welsh National Exhibition.
Derby.—June 28th to July 3rd, Royal Agricultural Show.
Folkestone.—June 20th to 29th, Health Exhibition.
Glasgow.—November 1st to 19th, Shipbuilding, Engineering and Electrical Exhibition.
Leeds.—July 21st, Yorkshire Agricultural Show.
Canada (*Toronto*).—August 27th to September 10th, Canadian National Exhibition.
Austria.—(*Vienna*), September 11th to 17th, International Fair.
Czecho-Slovakia.—(*Pressburg*), August 6th to 15th, Czecho-Slovak Industrial Fair; (*Reichenberg*), August 13th to 21st, International Fair.
France.—(*Bordeaux*), June 15th to 30th, International Samples Exhibition.
Holland.—(*Utrecht*), September 6th to 16th, International Industrial Fair.
Latvia.—(*Riga*), August 1st to 28th, International Agricultural and Industrial Exhibition.
Norway.—(*Christiania*), September 4th to 11th, Norwegian Industries Fair.
Spain.—(*Barcelona*), September 1st to 10th, International Samples Fair.
Sweden.—(*Gothenburg*), July 4th to 10th, Fair.
Argentina.—(*Buenos Ayres*), 1922, International Exhibition.
Brazil.—(*Rio de Janeiro*), 1922, International Centenary Exhibition.
Java.—(*Bandoeng*), September 9th to October 19th, Netherlands East Indies Fair.
Mexico.—September, Commercial and Industrial Fair.

Work and Wages.—The dominant note in the June issue of *The Electron: the Electrical Workers' Journal* is disappointment at the failure of the "Triple Alliance" to bring about a general strike, and dissatisfaction with the policy of trade union leaders in general. A full account is given of the negotiations with the N.F.E.A. with regard to wages, and it is stated that at the meeting with the employers both sides agreed to recommend a reduction of 10 per cent. in two instalments of 5 per cent. on May 9th and July 9th respectively, "in accordance with the wages agreement." The representatives of the E.T.U. informed the N.F.E.A. that nothing further could be done till the members had voted on the recommendation, the earliest date for the result to be known being May 7th. Without waiting for the announcement of the voting, however, on May 4th notices were issued by the N.F.E.A. putting in force the first reduction, and in accordance with the instructions of the Executive Council of the E.T.U., members affected at once ceased work. On May 9th the result of the ballot was announced to be against the reduction, and strike orders were issued. Since then, as our readers are aware, the strike has been called off.

Reviewing the articles on "The Labour Situation," by Mr. T. W. Cole, which appeared in our pages recently, *The Electron* congratulates the author on having "studied the subject and attained a grasp of the elementary facts of the Labour movements," but is surprised at his omission of "Sovietism"—unless, indeed, he includes it "under his fourth category of Anarchism." The reviewer has little fault to find with Mr. Cole's treatment of the subject, being especially impressed with his clear understanding of the various

forms of Socialism; but he makes it clear that his own policy is "The good old rule, the simple plan—that they shall take who have the power, and they shall keep who can," when he says: "Under the present system, the stockholders are the legal owners of the undertakings, while the workers, though in actual possession, have no rights beyond their claim to wages. But that system is doomed." "As surely as feudalism followed barbarism, and industrialism displaced feudalism—as surely as plutocracy superseded aristocracy—so surely will workers' control come, and be followed by workers' ownership of the means of production and distribution."

New French Companies.—There has been constituted as a company at Paris (103, Rue du Cherche-Midi) the Etablissements Desgouttes et Cie, with a capital of 1,300,000 fr., for the prosecution of the electro-mechanical industry.

Under the style of Lustre-Lumière has been formed a Société Anonyme with a capital of 300,000 fr., for the manufacture and sale of electric lighting apparatus, and more particularly the Lustre-Lumière products. The offices are at 20, Rue Malher, Paris.

For the purchase, sale, and manufacture of Edison accumulators the Agence Française de la Société Continentale de l'Accumulateur Edison has been formed at Paris (6, Rue de Sèze) with a capital of 550,000 fr.

With a capital of 250,000 fr. has been formed at Paris (24, Rue Vavin) a company for the manufacture of electric lamps and other small electrical accessories.

The Entreprise Générael de Travaux Publics et d'Electricité has been embodied with a capital of 2,000,000 fr. in 500 fr. shares for the carrying out of public and private installations in all countries. Its offices are at 2, Rue de la Pépinière, Paris.

With a capital of 400,000 fr. in 500 fr. shares, has been launched the Triphasé Standard C.G.M., whose objects are the construction, purchase, and sale of electric motors and their accessories. The offices are at 42, Rue de Lagny, Paris.

Electric Vehicles in Germany.—*Elektrische Kraftbetriebe und Bahnen*, quoted by the *Technical Review*, states that in 1906, the North German Automobile-Motor Co., of Bremen, manufactured electric wagons of a pattern in accordance with a French patent. These did well in practice, and some are still in use after 14 years on the road. During and since the war a new type of wagon has been brought out capable of taking 4 to 5 tons as freight load, and also a wagon-trailer. The battery is accommodated on the frame and can easily be exposed by taking off the cover and turning down the side piece. The driving switch has been carefully considered and is placed in front of the driver under a hood, and is thus very easily accessible. The current consumption with 4-ton freight load and a speed of 13.35 km. per hour is 38.5 amp. at 154-volt pressure on the level, 48.6 Wh per ton-km., or 112 Wh per freight ton-km. Taking an average for the year it is calculated that for one km. traversed per wagon there is one kWh charge current including the unavoidable current losses at charging and tending the battery. A smaller and lighter type of vehicle has recently been made by the Hansa-Lloyd Works.

Book Notices.—"Coal Mines Act, 1911: General Regulations as to the Installation and Use of Electricity, with Explanatory Memoranda." (73 pp.) London: H.M. Stationery Office. Price 1s net. The first 18 pages reproduce the regulations, the remainder of the publication being taken up by the Memorandum. The latter is divided into two parts devoted respectively to the consideration of the effects of the Regulations upon the use of electricity both below and above ground, and with apparatus used above ground only. Methods of procedure in notifying the inspector of a division of the intention to install electrical apparatus are given.

"Testing of Continuous-Current Machines." By C. F. Smith. Pp. x + 102; figs. 20. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

A Swedish Telephone Manufacturing Monopoly.—According to the *Svensk Handelstidning*, an important consolidation of the telephone apparatus industry is impending. The newspaper states that it has long been an open question as to how the Allmanna Telefon Aktiebolag L. M. Ericsson would proceed with regard to its foreign engagements which were thought to have involved serious losses, owing to the war and the subsequent crisis. The prospects for the subsidiary undertakings in Russia are such that the parent company cannot include the resulting obligations at the values at which they have hitherto stood in the balance-sheet, while the American subsidiary has recently had to work under very unfavourable conditions, so that losses in this case also will have to be reckoned with. The factories in Sweden are well occupied under the present state of trade, and most of the foreign subsidiary companies are also in a favourable situation. It would certainly be possible to devote the profits earned by the parent company and the foreign companies so as gradually to write off the losses on the Russian engagements, but this would imply a very tedious procedure and bring about for the shareholders a deprival of dividends for a number of years. Under these circumstances, the question has been discussed within the management as to the advisability of writing down very considerably for depreciation and of eliminating all the doubtful matters at one time, and a decision in this respect, the newspaper asserts, may be expected in the near future in connection with the presentation of the financial results for 1920.

The shares held by the company in the Swedish-Danish-Russian Telephone Co. were entered in the balance-sheet for 1919 at 6,130,000 kr., those in the Russian L. M. Ericsson Co. at 2,480,000 kr., and those in the Telephone Construction Co., of Moscow, at 500,000 kr., making a total of 9,110,000 kr. In initiated circles, the newspaper remarks, it has been suggested that the consolidation should be carried out so thoroughly that not only the year's profits and all the reserves, but also one half of the share capital should be written off. The share capital amounts to 73,260,000 kr., the reserve funds to 9,820,000 kr., and other funds to 50,000 kr. If, then, this statement should be confirmed, the total amount to be written off would be about 50,000,000 kr.

Apart from the scheme of financial consolidation, proposals are said to be under consideration for increasing the competitive capability of Swedish telephone apparatus by the merging of the H. T. Cedergren General Telephone Co. into the Ericsson Co. Such an amalgamation would imply that practically the whole of the manufacturing of telephone apparatus would be vested in one company, and the fusion would be simplified by the fact that the Ericsson company already holds the majority of the shares in the other company.

Belgian Contracts and Foreign Competition.—The principal reasons for the lack of success of United Kingdom firms in obtaining the numerous important Belgian contracts which have been notified are, states His Majesty's Commercial Secretary to His Majesty's Embassy at Brussels (Mr. R. F. H. Duke, M.B.E.), the present adverse rate of exchange and the activity of Belgian firms to supply the materials required. The majority of contracts which have come to the Commercial Secretary's notice have been obtained by Belgian firms, simply because British contractors have had to quote prices in a currency which has depreciated by 100 per cent. It must be remembered that industry in Belgium has, with few exceptions, almost completely recovered since the armistice, and also that the present trade depression makes firms willing to quote their lowest rates in the hope of obtaining an order and employment for their operatives.

In this connection the *Chronique des Travaux Publics* of April 24th, published an article according to which the Belgian Railway Department has examined the question of the participation of German firms in public tendering. That Department considers that no general rule can be laid down on the principle of permitting foreign competition, but that certain restrictions should be imposed favouring Belgian industry. Where Belgium is not necessarily dependent on foreign supplies it is proposed to give preference to tenders quoting unconditional prices in Belgian francs. It is also proposed to exclude foreign firms from contracting for public works of national importance from the point of view of defence. It is further stated that the Department considers that in present circumstances German and other foreign firms shall not be excluded in general from Belgian adjudications, but that a considerable right of preference ought to be accorded to Belgian firms in view of the difficult trade situation in that country.

E.D.A. Activities.—The latest departure of the British Electrical Development Association, Hampden House, Kingsway, W.C. 2, is an effort to educate the ordinary user of electricity; at least, that is what the title suggests, but we think the booklet (E.D.A. 162 "What the User of Electricity ought to Know") should also be addressed to the *non*-user. It is a description of the numerous advantages of electricity, the "silent servant," and is designed to cause the consumer to realise that lighting is by no means the only service rendered by electricity. The back cover illustrates methods of treating lamps, shades and connections and is really necessary to prevent common abuses. These illustrations might, with advantage, be extended to cover other appliances and fixtures.

Rathenau's Industrial Trust Scheme.—The London correspondent of the *Birmingham Post* writes as follows, under the title, "A Mammoth German Trust":—"I find myself rightly taken to task for not having been more explicit the other day when saying, touching a recent up the sides of the pit in which Germany now lies, that Germans were facing the facts of their poverty squarely, and were thinking out new forms of industrial and social organisation. What I had in mind was Herr Walther Rathenau's scheme for the co-ordination of all German industries and commerce in one *kartel* or trust, operating under a charter granted by the State. It is an integral part of his plan that there shall be a systematic and continuous application of science to industry, with the object of getting cheaper and better production all along the line. The idea may be good or bad; there must be something in it, for Herr Walther Rathenau is at the head of the Allgemeine Electrizitats-Gesellschaft, and before the war was one of the greatest of German industrialists. He is no theorist. I have not seen the pamphlet in which the plan is set forth, and it is not yet obtainable in English. I write from recollection of a summary, and have got hold only of the central idea. Whether it is an impracticable idea or not is not relevant to the point that Germans are doing some very hard thinking. I had also in my mind Herr Rathenau's 'The New Society,' which faces the facts of post-war German life with a candour which is almost terrible, and yet opens out a path of recovery—a very flinty and toilsome path indeed, for the author is no idealist, but the sternest realist. I make these points purely to illustrate the sort of work German brains are now doing under the stimulus of defeat and poverty. They may be down and under now, but they will be a formidable people to be in competition with in a decade or two."

Applications for British Trade-Marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods and articles connected with the electrical trades and industries :—

Langham (lettering and design). No. 410,982. Class 5. Electro-magnetic machinery, motors and dynamos. Francis F. Herbert Schroeder, trading as the Langham Engineering Co., 2A, Park Street, Slough, Bucks. December 24th, 1920.

F.R. (lettering and design). No. 412,960. Class 6. Electric motors and dynamos. Firth & Russell, Stirling Works, Shafton Lane, Holbeck, Leeds. March 1st, 1921.

Newivo'd. No. 413,143. Class 13. Incandescent electric lamps. Aladdin (Lancashire and Yorkshire), Ltd., 162, Stuart Road, Walton, Liverpool. March 7th, 1921.

Cycaro. No. 412,815. Class 18. Electric welding apparatus. Handstock, Ltd., 2, Harewood Place, Oxford Circus, London, W.C. February 23rd, 1921.

Belleroid. No. 412,420. Class 40. An ebonite compound for electric insulating purposes. Barrett & Elers, Ltd., 127-9, Wallis Road, Hackney Wick, London, E. February 11th, 1921.

Trade with Greece and Spain : Official Visits to London.—Mr. E. C. D. Rawlins, Commercial Secretary to H.M. Legation at Athens, has arrived in this country on a short official visit. He will be pleased to meet manufacturers and merchants who wish to discuss with him questions relating to trade with Greece, and who may desire information or advice regarding the appointment of agents, marketing and distributing goods, terms of payment, Customs duties or general information as to openings existing for British goods. Applications to interview Mr. Rawlins should be made immediately to the Department of Overseas Trade, 35, Old Queen Street, S.W. 1, the Reference Number 3,057 T.G. being quoted.

Captain U. de B. Charles, Commercial Secretary to H.M. Embassy at Madrid, has also arrived here, and will be pleased to meet manufacturers for similar purposes. Interviews with Captain Charles may be arranged by communicating with the above Department, quoting the Reference 3,055 T.G.

America and Chinese Industry.—American machine works, electrical, engineering, and shipbuilding companies have opened headquarters in Shanghai, and are planning to keep trained technical men at the offices. Plans for the Tsinan waterworks project are being made, and when completed the firms which have been interested will be asked to make tenders. The Chinese are reported to be seeking American participation in the development of the island of Hainan. The Amoy Tinning Co. and the China Canning Co., Amoy, are planning to enlarge their plants with more extensive connections abroad. The Japanese cotton-spinning industry at Tsingtau is developing very rapidly, with 50,000 spindles in operation and 200,000 more in view.—*Commerce Reports.*

The E.T.U. and Non-Unionist Wiring.—The Hackney Case.—According to the minutes of the Electricity Committee of Hackney Borough Council, the employés of the electricity department have refused to connect six installations, including the one which was the subject of the recent action. A summons has been issued against the Council in respect of another of the premises, but the hearing has been adjourned pending the result of an appeal to the High Court against the decision in the first. In view of the serious aspect of the question, the Committee has applied to the Council for definite instructions as to the policy to be adopted.

The summons above mentioned has now been restored to the list for early hearing.

Dr. Rathenau's New Post.—Dr. Walther Rathenau, of the Allgemeine Elektricitäts Gesellschaft, Berlin, has accepted the post of Minister of Reconstruction. Our readers will remember the prominent place that Dr. Rathenau filled during the war as the organiser of raw material supplies on behalf of the German Government. The Berlin correspondent of *The Times* describes him as "next to Stinnes, perhaps the best-known industrialist in Germany."

Australian Wiring Rules.—A copy of the Wiring Rules of the Fire Underwriters' Association of Victoria revised to January, 1921, which has been received from His Majesty's Senior Trade Commissioner in Australia (Mr. S. W. B. McGregor), may be consulted in the Inquiry Room of the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1. These rules, which are those of the Institution of Electrical Engineers adapted to meet Australian conditions have been adopted by the fire underwriters of all the States of the Commonwealth, and embody the requirements and precautions framed to secure satisfactory results with a supply of electrical energy at low and medium pressures.

Oil Fuel.—We have received from the Lawton Machine Tool Co., Burgess Street, Sheffield, some idea of the ease with which coal-fired boilers can be fitted with oil-fuel burners to enable the furnace to burn oil alone, oil and coal, or coal alone. They say that 1 ton of oil is equivalent to 2·7 tons of coal, and that the cost of installing oil burners is in this way soon covered by the economy effected.

Metalliferous Mines.—An Advisory Committee has been appointed for the metalliferous mining industry, with Sir Cecil Lindsay Budd, K.B.E., as chairman. Mr. F. C. Starling, of the Mines Department, will act as secretary to the Committee.

The Bath Show.—Messrs. Jennings, Ltd., of Bristol, are represented at stands Nos. 314 and 315 at the Bath and West Show, which closes at Bristol on June 4th. They have a varied exhibit of their joinery and other goods, including electric casings, asbestos tiles, &c.

German Exports to Russia.—The total value of German exports to Russia between May and December, 1920, amounted to 204,100,000 marks. Insulators represented 4,700,000 marks of the total value ; electric lamps, 20,300,000 marks ; wire and electrical equipment, 2,500,000 marks ; and instruments, 300,000 marks.

Swedish Telephone Manufacture.—The Allmaenna Maustir Aktiebolag H.T. Cedergren reports net profits of 1,295,000 kr. for 1920, as contrasted with 2,300,000 kr. in the preceding year, and it is proposed to pay a dividend of 3 per cent., as against 7 per cent. in 1919. A preliminary agreement has been entered into between the directors and those of the Ericsson Co., with a view to the undertaking of the former being absorbed by latter company.

German Porcelain Exports.—It is announced that the exports of German porcelain for electrical purposes, which have hitherto been subject to limitations, have now been released from control so that makers are able to export as freely as possible.

A French Amalgamation.—The Compagnie Générale d'Electricité proposes to absorb the undertaking of the Société de l'Accumulateur Tudor, and for this purpose is offering an interchange of shares with the shareholders in the latter company.

Spanish Customs Tariff.—The *Board of Trade Journal* for May 26th contained a special supplement giving details of the new Spanish Customs Tariff which came into force on May 21st. This Tariff will remain in force as a provisional measure pending the more permanent revision of the Spanish Tariff.

Lead.—Messrs. James Forster & Co. report, under date May 28th :—"No imports of soft pig lead for the Thames have taken place since 9th inst., nearly all of which were used for declarations against April contracts, and it is doubtful whether any steamers will arrive this month, although two are due about 31st inst. In consequence there has been some pressure this week from consumers for lead *ex* contract, and a considerable premium has been paid for immediate delivery. The market is so entirely under the influence of speculation that any forecast is useless. One thing is certain, and that is, that present supplies are quite inadequate for any normal demand."

Postage Increase.—At the annual meeting of the Northern Section of the Electrical Contractors' Association, at Leeds, on May 25th, representing the trade for the area between Sheffield and Newcastle and between Hull and Liverpool, a resolution was carried unanimously, on the proposition of Mr. Harry Moss, of Bradford, in which, among other things, it was recorded that the meeting viewed with alarm the further increase in postage rates, which was going to add considerably to the expenses of all businesses. The meeting considered that an investigation of the Post Office Department and its working should be made by business men, with a view to finding out the cause of the present deficit, and the necessity for the further increases in postal rates.

Calendar and Blotter.—Messrs. W. Coates & Sons, of Nottingham, makers of rope and twine, have sent us a blotter with the outlines of a bale of rope, bearing a calendar for the July-September quarter.

American Society for Electrical Development.—It is announced that at the annual meeting of the Society, held in New York, Mr. W. W. Freeman was elected president. Among the Society's activities is the following up of reports in the Press of fires caused electrically. The truth is ascertained and published, and this has removed the erroneous impression that the majority of fires in the United States are due to electricity.

New Indian Company.—A new company has lately been formed at Jullander (Rujat), with a capital of 1,000,000 rupees, and the title the Jullander Electric Supply Co., to establish a central electricity distributing station in the town.

Anglo-Canadian Trade.—Reuter's Trade Service learns from the Chief Canadian Government Trade Commissioner, 73, Basinghall Street, E.C.2, that the Minister of Trade and Commerce has appointed Mr. L. D. Willgress, an experienced Trade Commissioner, to undertake a special mission for the purpose of discussing with United Kingdom firms who purchase goods of all kinds on behalf of overseas customers, the possibility of their obtaining a larger proportion of their requirements from Canada. Mr. Willgress has now arrived in London and would be glad to have the opportunity of an interview with any firm interested.

Country of Origin.—The Canadian Government recently decided that all goods imported into Canada must be marked so as to indicate the country of origin. The Council of the British Empire Producers' Organisation has just passed a resolution urging the British Government to take steps without delay to impose similar conditions in connection with the importation of goods into the United Kingdom.

LIGHTING AND POWER NOTES.

Aberdeen.—EXTENSIONS APPROVED.—At a meeting of the Electricity Committee, on May 25th, a letter was received from the Electricity Commissioners intimating their approval to the scheme of extensions submitted to them. It has not yet been decided to proceed with these extensions, which are estimated to cost £200,000.

Bexley.—IMMERSION HEATERS IN HOUSES.—In connection with the Welling housing scheme, the Urban District Council has decided to install in 22 houses electrical immersion tubes for heating coppers, instead of tenants having to utilise fuel or gas.

Bingley.—LOAN.—The Urban Council is applying to the Electricity Commissioners for permission to borrow £1,500, the cost of prospective new services.

Chester.—ELECTRICITY FROM FACTORY.—The Electricity Committee has received a letter from the Electricity Commissioners with reference to the proposal to obtain a bulk supply of electricity from H.M. Factory, Queensferry, which says that this should be utilised by the Corporation, at any rate for the time being. The letter states :—"Pending the establishment of the Joint Electricity Authority, and until such time as the North Wales Power Co. may be authorised to exercise the powers of such authority, it will be necessary for the Chester Corporation to erect the transmission line and install the plant needed to obtain a bulk supply from the Queensferry Works for Chester. It is not possible in the circumstances for the Minister of Transport to construct the line and install the plant under the provisions of Sec. 18 of the Electricity (Supply) Act, 1919. It will, however, be in order for the Corporation to approach the North Wales Power Co. with a view to arranging that they shall take over the line from the Corporation in the event of statutory effect being given to the Commissioners' decision, and with the concurrence of the company a provision to that effect could be inserted in the order. In the meantime the Commissioners will be prepared to entertain an application from your Corporation for sanction to a loan to cover the expenditure in connection with the said transmission line and plant." The Electricity Committee decided that the Town Clerk should communicate as suggested with the North Wales Power Co.

Continental.—SWITZERLAND. — Application has been made to the Federal Authorities at Berne by the Schweizerische Kraftübertragung Aktien Gesellschaft for leave to export from its collecting networks electric energy to the following companies beyond the Swiss borders :—1. To Alsace, to the Société Anonyme Forces Motrices du Haut Rhen, located at Mülhausen, and to the Société Anonyme d'Electricité de Strasbourg, a quota of 9,000 kW of summer energy, deliverable from April 1st to September 30th each year for 180 days, of which 120 are continuous : and a second quota of 4,500 kW daily of summer surplus energy, deliverable in the same period so far as the power is available. Under favourable circumstances, the delivery period may be extended, both in the spring and the autumn. From December 1st to the end of February the supply will cease in each year. This arrangement is to hold for 10 years. 2. To Lorraine, to the Compagnie Lorraine d'Electricité, Nancy—a quota of 5,500 kW, 24-hour summer energy for six months from April 1st to September 30th, and a second quota of 6,500 kW summer surplus energy for three months constant on demand, between April 1st and September 30th. From October 1st to the end of February the supply in all cases will cease. The agreement is for a duration of 15 years. Power will also be diverted to the Delle and Laufenberg works of the French companies, and a further 8,000 kW from the Mühleberg power station placed at their disposal from the beginning of the present year. In return for these supplies, the French companies named undertake, for five years, to supply coal at preferential rates to the Swiss company in the ratio of 275 gm. of coal for every kWh. The price is fixed at 75 per cent. of the usual market price on the Swiss frontier for coal, and holds so long as it does not fall below 100 Swiss francs per ton, duty free. After five years the French companies must supply winter energy instead of coal. The compact means that for the supply of from 30 to 60 million kWh the receivers undertake to return 16,125 tonnes of coal a year. This exchange has been variously regarded, but the Swiss company maintains that while it is selling its power much above the usual export price of electric energy, after the deduction of transport costs, a good balance will remain over on the coal acquired.

FRANCE.—The Senate has voted the necessary credits for the extensive scheme for the harnessing of the Rhone, and has approved the details of the plan, which should make the river an easily navigable waterway, a source of great hydraulic power, and a means of irrigation. M. le Trocquer, replying to various objections, pointed out that the water power would be so great that it would probably be possible for France to do without imported coal in the future, as the new scheme would effect an economy of 6 million tons of coal a year. The construction of a navigable waterway would connect Switzerland with the Mediterranean, and *via* the Rhine with the North Sea, so that direct communication by water could be obtained for vessels up to 1,200 tons right across Europe from North to South.

No fewer than 18 power stations are to be constructed along the course of the river, the largest of which will be at Genissat, near Bellegarde. The average production of this station will be 200,000 kW, equivalent to about 250,000 h.p. It is estimated that the stations will together produce a total hydro-electric force averaging 1,100,000 h.p.

The two most important utilisers of the new power will be the P.L.M. Railway Co. and Paris. The P.L.M. Railway hopes to electrify the whole of its lines included in the quadrilateral Bellegarde-Lyons-Marseilles-Vintimille. In this there should be no difficulty, as the necessary energy can be obtained all along the river.—*Reuter's Trade Service* (Paris).

The Compagnie Haute-Marnaise d'Electricité has applied for a concession to set up a series of distribution mains for the supply of 27 communes in the Département of the Haute Marne, and nine communes in the Département of the Vosges, of a total length of 175 km. The electricity will be supplied at a pressure of 30,000 volts, stepped down to meet consumers' requirements.

A telegram from New York to the *Journée Industrielle* states that American capitalists are ready to advance sufficient sums for the exploitation of the hydraulic power of the tide in the bay of Mont Saint Michel, which, it is thought, could be utilised industrially. A French Canadian, M. Coriolis, has already submitted a scheme in connection with the work to the French Government.—*Reuter's Trade Service* (Paris).

SICILY.—In a survey of the hydro-electric developments in Sicily, *The Times Engineering Supplement* describes a number of undertakings in course of construction. One of these plants is being erected on the River Alto Belice, and is expected to be completed next year. The station will house three 3,500-kVA three-phase alternators, generating at 10,000 V and driven by three turbines under a head of 1,550 ft. The second plant is that of Salso-Simetto (Catania). This is not yet commenced, but it is hoped to start on it shortly. The design provides for the construction of an artificial lake, with a capacity of 131 million cb. yards, by means of a dam 55 ft. high, on the Salso, near Aderno. The head of water available is 515 ft., and the continuous power output 15,000 h.p., with a maximum of 30,000 h.p. Another undertaking, which had to be suspended for financial reasons, included the construction of an artificial lake, with a capacity of 330 million cb. yards. The available power from this source is estimated at 150,000 h.p., with a maximum of double this figure. Electro-chemical works are to be erected on the spot when the scheme is resumed, and the surplus power transmitted a distance of 115 miles to Apulia and Messina.

SWEDEN.—According to the American Consul-General, at Stockholm, the total income from the Swedish electric power stations in 1920 was about 15,070,000 crowns, while that for 1919 was 12,370,000 crowns. While the length of the lines in the rural district has not been changed, remaining at 1,150 km. as at the close of 1919, the lines in the towns and villages have been increased from 2,960 to 3,425 km. The number of secondary stations remains the same as in 1919, 24 ; tertiary stations for general distribution have been increased from 240 to 270. On the main line from Trollhättan to Västerås (457 km.) surveys have been completed, and the foundations for the poles, from Orebro to Västerås (217 km) have been already laid. The State Waterfalls Board recently purchased from Trollhättans Elektrotermiska Aktiebolag two power contracts of 5,172 and 8,070 kW in anticipation of the regulation of the waters of Lake Väner.—*Commerce Reports.*

FINLAND.—The electrification of the rural district of Vihtis, in the Province of Nyland, has recently been completed, and is considered one of the most important undertakings of the kind in Finland. In 1919 the inhabitants of the district organised a company on the plan of each user of electricity subscribing for shares in proportion to the number of lamps and amount of horse-power that he uses. The main line, operating at 20,000 V, runs to a point near the Nummela Railway Station (about 50 km. from Helsingfors), where a large transforming station has been built—probably the largest in the country. The network of lines is so dense that nearly all the people in the district are able to obtain electricity. This system, like the one at Sallila, was planned and installed by the Hankkija Society of Helsingfors.—*Commerce Reports.*

Denny (Stirlingshire).—WORKING COSTS.—At a meeting of the Town Council, letters were submitted from the Scottish Central Electric Power Co. asking its consumers to give an undertaking to pay a proportionate share of the extra costs involved in carrying on the works during the miners' strike. The Council agreed to the request, provided it was satisfied as to the reasonableness of whatever increase might be asked for.

Dorking.—PRICE INCREASE.—The Electric Light Co. has been granted an order authorising a charge of 10d. per unit as from May 7th, and as from June 30th, a minimum charge of 12s. 6d. up to 15 units for the winter quarters, and of 8s. 4d. up to 10 units for the summer quarters.

Elland.—NEW STATION.—The District Council's new station for distributing of electricity, the energy being bought in bulk from the Yorkshire Electric Power Co., is now complete, and would have been started already but for the coal dispute. The former local generating plant will not be maintained. The generating scheme has never paid, and it is anticipated that under the new system the department will make a profit. The main building of the new station is 70 ft. long, and there is an annexe of 12 ft. The plant comprises two 600-kW rotary converters with transformers, and one 50-kW induction motor generator set, with its own transformer. There are foundations, transformer chamber and switchboard panels for a third rotary set up to 500 kW capacity, making a future total of about 1,200 kW direct current if and when required.

Epsom.—CHARGES.—The Urban District Council has fixed a minimum charge of 40 units per annum to all private consumers as from the June quarter's readings. For the new houses, each tenant is to be charged 1s. 6d. per week on a seven-lamp basis.

Glasgow.—Dalmarnock Station (Correction).—In this column, last week, we described the new set at Dalmarnock as a "Metropolitan-Vickers turbo-generator set." Messrs. Fraser and Chalmers inform us that the turbine was manufactured by them, while the generator is a Metropolitan-Vickers machine. The former firm also carried out the complete installation, including condensing plant.

Govan Station Closed.—The Corporation electricity station at Govan has now been discontinued as a generating station, and the manager has been instructed to dispose of the old plant.

Haywards Heath.—Company Scheme.—At a meeting of the Urban Council, on May 23rd, the clerk submitted a draft order and plans for the erection of a power station by the Haywards Heath and District Electric Supply Co. The General Purposes Committee had previously decided against the inclusion of a purchasing clause in the Order, but the Council thought this necessary, and it was, therefore, moved and carried that a clause enabling the Council to purchase the undertaking at a fair price after a period of years be inserted.

India.—Hydro-Electric Surveys.—Several hydro-electric surveys have been undertaken by the Assam Government. The Hukong Valley scheme appears to be a very promising project. The scheme, if carried out, should prove one of the cheapest and most powerful hydro-electric installations in India.—*Reuter's Trade Service* (Bombay).

Developments at Calcutta.—Extensive developments are being carried out by the Electric Supply Corporation, Ltd. The extensions, which are estimated to cost 130 lacs of rupees, include the increasing of the capacity of the Cossipore plant by 21,000 kW; a new 30,000-V ring main to supply the outer districts; the laying of five submarine cables across the Hooghly to the Howrah district, and the erection of several new transformer stations.

Ireland.—Water Power.—The report of the Committee on Ireland's Water Resources, which has just been issued, says that about 500,000 water h.p. is available continuously, and can be economically developed. The water power is equivalent to that generated in coal-fired stations by the annual consumption of more than 7,500,000 tons of coal, on the basis of 5 lb. of coal per h.p. per hour, which is the figure taken by the Coal Conservation Sub-Committee as the average practice in the United Kingdom. The value of this water power, if developed, it is stated, would be at least £10,000,000 per annum. Detailed schemes for the development of the Lower Bann, the Lower Shannon, the Lower Erne, and the Liffey are suggested, and the Committee regards the Boyne, the Strule, the Mourne, the Lee, the Boyle, the Corrib, and the Blackwater (Cork) as worthy of immediate investigation.

Kingston-on-Thames.—Loan Sanctioned.—The Town Council has received sanction to a loan of £18,000, for expenditure on the extensions of plant installed by arrangement with the Ministry of Munitions, in excess of the engineer's estimate of £45,000. The sum applied for was £19,750.

Leek.—Deficit.—There was a deficit on the working of the electricity undertaking of the U.D.C. for the past year of £2,149.

Leyton.—Loan.—The Electric Lighting Committee recommends application to the Electricity Commissioners for sanction to borrow £4,972, excess expenditure incurred in connection with the execution of the necessary works for obtaining a bulk supply of electricity from Walthamstow.

London.—Greenwich.—The architect in charge of the Greenwich Council's housing scheme at Charlton informs us that, owing to the high cost of wiring, fittings, and electricity, the houses being erected are to be fitted with gas appliances only.

Mansfield.—Loan.—The Electricity Committee is applying to the Electricity Commissioners for sanction to the borrowing of £2,500 for the purchase, installation, &c., of feeders and distributing mains required in connection with the Mansfield Woodhouse housing scheme, and £1,500 for the purchase of meters.

Newton Abbot.—Extension of Time Required.—The Council has been recommended to ask the Urban Electric Supply Co. for an extension by one year from July next of the time allowed for decision about the purchase of the local electricity supply undertaking.

New Zealand.—Further Lake Coleridge Developments.—Speaking at Christchurch in January, the Minister of Public Works said that the 8,000-h.p. plant at Lake Coleridge was overloaded to the extent of 1,500 h.p., but plant of 4,000 h.p. was being installed for the present winter. In 1922 provision would be made for an additional 4,000 h.p. All the money which had been set aside for electrical extensions, £750,000, would be expended. The plans and specifications of the power house had been approved, but certain surveys were still to be made. A new 10-ft. tunnel and a pipe-line would bring the available power up to 30,000 h.p. It would also be necessary to double the capacity of the transmission lines to Christchurch, and make extensions to South and North Canterbury. Government operations were only restricted by the difficulty of obtaining sufficient funds for the purpose.

Nigeria.—Projected Power Scheme.—At a meeting of shareholders of the Keffi (Nigeria) Consolidated Tin Co., it was stated that the only company which had done anything towards instituting an electricity supply was the Northern Nigerian (Bauchi) Tin Mines Co., but the undertaking had had to be abandoned owing to lack of funds. The Keffi Co. would not employ its resources in this direction, but it was hoped to give shareholders an opportunity to form another co-operative company to carry out a power scheme.

Plymouth.—Year's Working.—The accounts of the Corporation electricity undertaking for the year ended March 31st last, show that the total revenue was £124,629, as compared with £92,957 in the previous period. Working expenses reached a total of £96,587, as against £69,785, leaving a gross profit of £28,042 (£23,172). The net result, after payment of capital charges, &c., was a profit of £4,666, exceeding the estimate by £1,104. Last year there was a profit of £274.

South Shields.—Loan Inquiry.—On May 24th Mr. J. C. Dawes, of the Ministry of Health, conducted an inquiry into the circumstances attending the Corporation's application for sanction to borrow the sum of £1,890 for the provision of additional charging plant for the electric vehicles used by the scavenging department.

Stoke-on-Trent.—Loan.—Sanction is being sought by the Council to a loan of £1,400, the estimated cost of extensions at the Burslem sub-station.

Todmorden.—Loan Sanctioned.—Sanction has been received from the Electricity Commissioners to the borrowing of £1,860 for new mains, and £400 for meters. The Extensions Sub-Committee has been instructed to consider the question of extending the cable to Cornholme.

Worksop.—Overhead Cable.—The Urban Council has approved the installation of an overhead cable, at a cost of £3,500, to supply a model village being erected by the Shirecaks Colliery Co., Ltd.

Wrexham.—Bulk Supply.—The Town Clerk of Wrexham has written to the Chester Electricity Committee stating that a sub-committee of the Wrexham Electricity Committee desires to meet representatives of the Chester Corporation with reference to a temporary supply of electricity from H.M. Factory at Queensferry. A meeting is being arranged.

TRAMWAY AND RAILWAY NOTES.

Continental.—Switzerland.—On the proposal of the Director-General of Federal Railways, the Council of Administration has agreed to order 32 electric locomotives, and four motor coaches, and has granted a credit of 24 million francs for this purpose.—*Reuter's Trade Service* (Berne).

Russia.—A Reuter telegram from Reval recently stated that the tramway and railway employés of Petrograd were on strike owing to lack of bread. They demanded that the State should distribute the bread rations which were withdrawn when freedom of trade was re-established.

France.—A special electric train proceeding from the Antigues, left the rails on an incline near Gripp Bagnères-de-Bigorre, owing to a failure of the brakes. The train left the rails and overturned down a bank, nine people being killed and 13 injured.

The Riviera.—An entirely new form of transport is to be tried where travelling between the coast and the hilly country inland is not easy on account of the steep gradient, and work has been begun on an "aeroplane railway" which is to link up Peira Cava, 4,500 ft. above the sea level, with Nice and Monaco. The aeroplane will be attached to a fixed line, and will not be able to deviate from it. The scheme has been worked out by the Engineer Coanda, and has been adopted by the Minister of Public Works and by the local authorities. The "railway" will consist of four cables attached to supports, the height of which will vary from 15 ft. to 100 ft. according to the conformation of the ground. The aeroplane will be attached to the cables, electricity being conveyed to the motor by three out of the four cables, the fourth being reserved for telephonic purposes. The aeroplanes employed will be of two types: the first, with a 300-h.p. motor, to carry eight passengers, and the second, with a 600-h.p. motor, to carry 20 passengers. Work has been begun at Escarene, Lucéram, and Peira Cava, which, with Nice, will form the four stations of the first line. The line will be perfectly straight, so that the full benefit may be obtained from the ascensional capacities of the aeroplane. The first trials will be made over a distance of 6 km. in that part of of the "railway" where the gradient is the steepest. If the trials are satisfactory, the Nice-Peira Cava line, 40 km. long, will be constructed and the linking-up of Peira Cava with Monaco will then be studied.—*Reuter's Trade Service* (Paris).

Edinburgh.—No "Universal" Fare.—In a report to the Council, the manager of the tramways says that the establishment of a "universal" fare, based upon the average fare paid per passenger, is impossible in Edinburgh, as the undertaking is so dependent upon the short-distance travellers. The effect of such a fare would be to cause short-distance travellers to refrain from riding, and the increase in the number of long-distance travellers would not compensate for the loss. It would be necessary to attract additional traffic by a revision of fares when through-running by means of electric cars was obtained.

Halifax.—New Track.—The Tramways Committee has instructed the borough engineer to construct a cross-over at Lee Mount at an estimated cost of £380.

India.—Electric Railway.—The survey for a railway through the Hukong Valley to Burma is now nearing completion; the early maturing of the railway project is far more likely if it can be shown that a source of cheap power is available for working the line. The line is to be electrified throughout.—*Reuter's Trade Service* (Bombay).

Mansfield. — Increased Price for Power. — The Town Council has entered into an arrangement with the tramway company whereby the latter will pay an increase of 70 per cent. for electricity supplied.

Newcastle. — Light Railway Order. — The City Council is applying to the Light Railway Commissioners, under the Light Railways Acts, 1896 and 1912, for an Order permitting it to construct a light railway commencing at North Gosforth and terminating at Longbenton by a junction with the Council's existing tramways.

Philippines. — Railway Electrification. — With regard to the plans of the Manila Railroad Co. for the use of electric motive power on its road, the bulletin of the Philippine Government Commercial Agency in New York states that the electrical power will be developed from the Agno River, in central Luzon, which is believed to possess a potential capacity of from 12,000 to 15,000 h.p. A thorough topographical survey of the entire water-power site is being undertaken, and early reports of the survey would seem strongly to point to the feasibility of the project.—*Commerce Reports.*

Sunderland.—Year's Working. — The report of the manager of the Corporation tramways for the year ended March 31st last, shows that the total revenue was £158,164, compared with £149,126 for 1919-20. Working expenses amounted to £136,667, as against £122,784, leaving a gross balance of £21,497 (£26,342). The payment of income-tax, loan interest, and £9,159 to appropriation account resulted in a net deficit of £1,142. It is stated that working expenses have risen to 16·8d. per car-mile.

Tynemouth.—Option of Purchase.—At a meeting of the Town Council, on May 25th, the Tramways Committee reported that Mr. Stagg, the local director of the Tynemouth Traction Co., had attended its meeting and referred to the rights of the Corporation to purchase the company's undertaking within six months from December 31st, 1922, or at the end of each septennial period thereafter. Mr. Stagg said the company did not feel justified, under those circumstances, in expending capital upon improving the system. He asked whether the Corporation desired to purchase the undertaking, or, if not, if it would grant the company a lease for, say, 21 years. Alderman Gascoigne, in presenting the report, stated that there would shortly be another meeting, and they hoped to put a definite proposition before the Council.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Compulsory Wireless on Ships.—Under navigation regulations which have been adopted by the Commonwealth Government, and will come into force on October 1st, practically all ships conveying more than 12 passengers from point to point on the Australian coasts will be compelled to carry wireless telegraph apparatus and operators.—*Reuter's Trade Service* (Melbourne).

Empire Press News.—A deputation representing the British Press was received by Mr. Winston Churchill, Colonial Secretary, on May 25th, when strong representations were made regarding the need for quicker and cheaper means of inter-Imperial communications for Press messages by cable and wireless telegraphy. It is understood that an official report will be issued after Mr. Churchill has consulted with other Ministers.

France.—Wireless Telegraphy.—Hitherto wireless communication from Paris to New York has been *via* Lyons or the new station at Croix-d'Hins, near Bordeaux. Now, however, French experts, as the result of experiments in connecting the sending boards in Paris with the transmission apparatus, declare that direct communication between Paris and New York can be obtained, thus reducing the time of transmission by two hours.—*Reuter's Trade Service* (Paris).

New Wireless Service.—By agreement with the Norwegian authorities, the administration of the French Posts and Telegraphs has opened the wireless service between France and Norway to the public during certain hours of the day, says *The Times*.

Long-Distance Telephony.—Experiments will shortly be made on the longest distance telephone which has yet been installed in France. The authorities are anxious that it should be possible to telephone from Paris to the Moroccan seaport of Casablanca, a distance of about 3,750 miles. M. Laffont, Minister of Posts and Telegraphs, is to conduct the experiments in person, and has left for Casablanca with a number of officials to carry out the trials. If the experiment is a success, similar apparatus will be used for other long-distance telephone lines to link up Paris with various important centres in Europe.—*Reuter's Trade Service* (Paris).

Ireland.—Cables Cut.—Queenstown was unable to communicate by wire with surrounding districts on May 24th, even the Admiralty could not communicate with Haulbowline, as the cables from Whitepoint had been cut.

Italy. — Strike. — Postal, telegraph, and telephone workers in Rome and several other Italian towns left work on May 25th, as a protest against the Government's delay in adjusting their scale of wages.

South Africa.—New Wireless Station.—The plant of the new wireless station, which was opened at Port Elizabeth on May 3rd, is a 1·5-kW set equipped with amplifying valves, and it has a guaranteed range in daylight of 300 miles, but it was demonstrated during the morning that the range can easily be exceeded, and under suitable conditions there is nothing to prevent a range of over 1,000 miles being attained. By virtue of the amplifier with which it is fitted, the new station has a greater range than that of the Durban station; it is exactly equidistant between the Durban and Cape Town stations, *i.e.*, 400 miles each way, and it ensures continual wireless communication along the south-eastern coast.—*Reuter's Trade Service* (Port Elizabeth).

Sweden.—Wireless Telegraphy.—The only wireless post on the West Coast of Sweden for locating ships off the coast is on the Island of Vangä, not far from Gothenburg. It is not, however, equipped with transmitting apparatus, and has to telegraph to Gothenburg the messages to be sent out. It is now intended to set up a second post, to be situated near Smögen. Great services have been afforded to international shipping lately by the former station when heavy fogs have overtaken ships in the Cattegat, Skagerrack, &c.

The Telephone Service.—New Exchange.—A new public telephone exchange called "Chancery" was opened, on May 28th, at 55, High Holborn. Its equipment is of the central battery type, with lamp signalling, and it will accommodate 1,500 subscribers' lines. A total of 520 lines was transferred from the Holborn, Central, and City exchanges on the first day.

U.S.A. — Control of Cable Landings.—The U.S. Senate, on April 26th, passed Senator Kellogg's Bill to prevent the unauthorised landing of cables in the U.S.A., or any of its possessions. The Senate's action followed protracted evidence before a sub-Committee of the Senate Interstate Commerce Committee, during which the story of the controversy between the Western Union Telegraph Co. and the State Department over the attempted landing of a cable at Miami was fully unfolded. The Bill gives the President sweeping authority to prevent cable landings in the U.S. or any of its possessions, to issue licences to land, or to revoke them, and he is given authority to obtain cable concessions for the U.S. in other parts of the world. Moreover, there is a purpose to secure in Latin-America better cable facilities, and to make the United States less dependent on foreign cables. Any cable now laid within the U.S. without a licence granted by the President may continue to operate 90 days from passage of the Act. The President may withhold or revoke a licence when satisfied that such action will assist in obtaining rights for the landing or operation of cables in foreign countries, or in maintaining the rights or interests of the U.S., or any of its citizens in foreign countries, or will promote the security of the U.S. The licence is not to give the licensee exclusive rights of landing, or of operation in the United States. The Bill provides for a maximum fine of $5,000 and imprisonment for one year. It applies to all the territory subject to the jurisdiction of the United States, including the Philippines and Canal Zone.—*T. and T. Age.*

The Western Union Co.'s cable ship has been withdrawn from Miami, which action is construed as evidence that a permit to land the cable connecting Florida with the British cable at Barbadoes has been refused.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Melbourne. — August 10th. Victorian Railways. 250 core-type impedance bonds for power signalling, with a capacity of 1,000 amperes per rail; also 50 miles of solid insulated copper wire, No. 14 Brown & Sharpe gauge, and 50 miles of solid insulated copper wire, 16 standard gauge.

August 15th. Electricity Commissioners. Steelwork for power station buildings, roof covering, &c.; water-tube boilers, stokers, fans, &c; platforms and ladders, steel chimneys, flues and dampers, sooting and dust extraction equipment, ash handling plant. (See this issue.)

August 17th. 3,000 sets of renewals for caustic soda primary cells.

August 30th. Board of Works. Four electrical centrifugal pumps, each with a capacity of twelve million gallons daily.

September 7th. Victorian Railways. Sixteen sets of air-brake equipment, 450 to 600 V., d.c., for single-track tramcars.—*Reuter's Trade Service* (Melbourne).

Tasmania.—P.M.G.'s Department. July 11th. Switchboard material (Schedule T. 317). (See this issue.)

Brighton.—June 7th. Electricity Department. Oil fuel plant. (May 20th.)

Dundee.—June 6th. Electricity Department. One coupled motor-generator, consisting of two interpole machines; motor, 400 V, d.c.; generator, 75 V, 130 amp.; also regulator, 60 to 70 V. (May 20th.)

Sudan.—June 30th. Sudan Government. Pumping machinery, consisting of Diesel or semi-Diesel engines and direct-coupled centrifugal pumps, capable of lifting 1,200 litres of water per second against a static head varying between 2·5 and 8 metres. Machinery must be delivered at Khartoum North by February 28th, 1922. Specifications, drawings, and conditions of tender may be seen at the office of the Sudan Agent, War Office, Cairo, Egypt. Tenders to Superintending Engineer, Department of Agriculture, Sudan Government, Atbara.—*Reuter's Trade Service.*

Greenock.—June 6th. Corporation. Electric lighting work in connection with the Upper Cornhaddock housing scheme (18 tenements and six double cottages). Schedules, &c., from Office of Public Works, Greenock.

Leytonstone.—June 16th. West Ham Union. Three months' supply of electrical fittings. Mr. T. Smith, Clerk, Board Room, Union Road, Leytonstone, E.11.

Liverpool.—June 6th. Liverpool Overhead Railway Co. Stores, including electrical fittings for twelve months. General Manager, 31, James Street, Liverpool.

Llandaff and Dinas Powis.—June 22nd. Rural District Council. E.h.p. feeder, with switchgear sub-station equipment complete. (See this issue.)

London.—ISLINGTON.—July 4th. Electricity Committee. H.p. switchgear, flame carbons. (See this issue.)

Manchester.—June 17th. Electricity Committee. Twelve months' supply of static transformers. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

New Zealand.—WELLINGTON.—June 28th. Public Works Department. Ten s.p. oil-filled transformers for the conversion of three-phase energy at 50 cycles, the voltage ratio being 50,000/11,000, for Waikato power scheme.*

June 28th. Supply and delivery at Lyttelton of two 50-kVA, two 100-kVA, and two 200-kVA condensers in connection with the Lake Coleridge electric power supply (Section 116).*

July 31st. H.M. Trade Commissioner in New Zealand has forwarded to the Department of Overseas Trade particulars of a call for tenders by the Wairoa Electric Power Board for a 11,000/3,300-V, 600-kW outdoor sub-station. The material required includes the following:—(*a*) Transformers, four 200-kVA, 11,000/1,900 single-phase units; (*b*) Insulators, 11,000 V and 3 000 V; (*c*) Air-break switches, 11,000 V and 3,000 V; (*d*) Fuses, 11,000 V and 3,000 V; (*e*) Lightning arresters and choke coils, 11,000 V and 3,000 V; (*f*) Accessories as per schedule. Tenders to the office of Messrs. Hay & Vickerman, Wellington. Copy of the specifications, conditions of tender and plan may be inspected on application to Room 49, Department of Overseas Trade, 35, Old Queen Street, S.W.1.

August 9th. Public Works Department. Suspension-type porcelain insulators for the Waikato power scheme.*

Nottingham.—June 16th. Electricity Committee. Twelve months' supply of general stores. (See this issue.)

South Africa.—July 5th. Electrification of Capetown-Simonstown and Durban-Maritzburg railway lines.

RHODESIA.—BULAWAYO.—August 3rd. Municipal Council. Electric light and power plant. (May 27th.)

TRANSVAAL.—Rand Water Board. September 9th. Erection of a complete installation of mechanical or other filters capable of filtering 5½ million gallons of water per 24 hours at the Vereeniging main pumping Station (Contract No. 232). Copies of the contract documents may be obtained from the Chief Engineer, Rand Water Board, Johannesburg, upon a deposit of three guineas.*

Uruguay.—MONTE VIDEO.—August 18th. State Electricity Works. Steel petroleum tank, Worthington duplex steam pump for oil, 250 metres steel tubing.*

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.

CLOSED.

Australia.—SYDNEY.—Electricity Supply Committee recommended:—

Underground cables (Spec. 628), £32,065.—W. T. Henley's Telegraph Works Co., Ltd.
Spare blading for 5,000 kW Westinghouse turbine, £343.—Metropolitan-Vickers Electrical Co., Ltd.

MELBOURNE.—City Council. Accepted:—

415 a.c. meters, £918.—British General Electric Co., Ltd.
500 d.c. meters, £1,972.—W. G. Watson & Co., Ltd.
13 tons bare h.d. copper cable.—British Insulated & Helsby Cables, Ltd.
10 switch pillars and 278 service boxes, £1,017.—Holden & Lewis.
—*Tenders.*

The Victorian Electricity Commissioners have accepted an Australian tender of £43,000 for the supply of condensing plant at Newport power-house.—*Reuter's Trade Service* (Melbourne).

Belgium.—No fewer than fourteen firms submitted tenders recently to the municipal authorities of Erquennes for the installation of a system of primary and secondary electricity supply mains in the town. The tenders ranged from 77,500 francs to to 134,723 francs, the lowest being that of Messrs. Dosin & Gallée, of Mons.

Glasgow.—Corporation. Electricity Committee. Accepted:—

Switchboards for the Kinning Park, Elliot Street and Partick sub-stations.

For the Kinning Park sub-station, £2,039.—Metropolitan-Vickers Electrical Co., Ltd.
For the Elliot Street sub-station, £1,094.—British Thomson-Houston Co., Ltd.
For the Partick sub-station, £351.—Metropolitan-Vickers Electrical Co., Ltd.

Corporation. Tramways Committee. Accepted:—

Rubber and asbestos goods.—G. McLellan & Co., Ltd., and North British Rubber Co.

Corporation. Lighting Department. Accepted:—

Electrical fittings.—Sloan Electrical Co., Ltd.; Wm. McGeoch & Co., Ltd.; W. Brown & Co.; General Electric Co., Ltd.; Wood & Cairns, Ltd.; British Thomson-Houston Co., Ltd.; Simplex Conduits, Ltd.

Government Contracts.—The following Government contracts were placed during April, 1921:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Cells.—Fuller's United Electric Works, Ltd.
Carbon rods.—Morgan Crucible Co., Ltd.
Supply and laying of cables, &c.—Macintosh Cable Co., Ltd.
Electrodes.—Quasi-Arc Co., Ltd.

WAR OFFICE.

Crucibles.—Morgan Crucible Co., Ltd.

AIR MINISTRY.

Direction finders.—Marconi's Wireless Telegraph Co., Ltd.
Electric mains.—Siemens Bros. & Co., Ltd.

POST OFFICE.

Telephone apparatus.—L. M. Ericsson Manufacturing Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone & Electric Co., Ltd.; Western Electric Co., Ltd.
Telegraph and telephone cable.—British Insulated & Helsby Cables, Ltd.; Pirelli-General Cable Works, Ltd.
Conduit and fittings.—Brotherton, Ediswan Tubes & Conduits, Ltd.; Perfecta Seamless Steel Tubes & Conduit Co., Ltd.
Cords for telephones.—Siemens Bros. & Co., Ltd.
Cradles for telephones.—Hodge & Co.
Cable drums.—Eames Bros.
Ducts.—Albion Clay Co., Ltd.
Insulators.—J. Bourne & Son, Ltd.
Laying conduits.—Holborn (Chancery Lane area) and London-Dorking (Section 5): J. Mowlem & Co., Ltd. Birmingham area: Whittaker-Ellis, Ltd. London-Uxbridge-High Wycombe (South-Midland Section): W. Jones & Sons. Waltham Cross-Epping-Pishop's Stortford (Section II): W. & C. French. Borough High Street and City of London: J. A. Ewart, Ltd. Saltcoats and Prestwick: W. Dobson. Monument-Exchange area: H. Farrow.
Manufacture, supply, drawing-in, and jointing cable.—Berkhampsted-Hunton Bridge, London-Chatham and St. Albans-Luton: Siemens Bros. & Co., Ltd. Barnet-Welwyn: W. T. Henley's Telegraph Works Co., Ltd. Preston-Blackpool: British Insulated & Helsby Cables, Ltd. Bury-Burnley: W. T. Glover & Co., Ltd.
Telephone exchange equipment.—Inverness: British L. M. Ericsson Manufacturing Co., Ltd.; sub-contractors for batteries D.P. Battery Co., Ltd.; for charging set, Crompton & Co., Ltd. Edinburgh Relief Exchange ("Museum"): Western Electric Co., Ltd.; sub-contractors for batteries, Hart Accumulator Co., Ltd.; for motor generator, Electrical Construction Co., Ltd.
Bronze wire.—Elliotts Metal Co., Ltd.
Leclanché zinc rods.—Eyre Smelting Co., Ltd.; Siemens Bros. & Co., Ltd.

HIGH COMMISSIONER FOR INDIA.

Accumulators.—J. Stone & Co., Ltd.
Cells.—Fuller's United Electric Works Co., Ltd.
Insulator cups.—Eatler Bros.
Generating sets.—Browett, Lindley & Co., Ltd.
Motors, &c.—Veritys, Ltd.
Transformer panels.—British Thomson-Houston Co., Ltd.
Switchboards.—Peel-Conner Telephone Works, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Telephones.—Peel-Conner Telephone Works, Ltd
Transformers.—Hackbridge Electric Construction Co., Ltd.
Voltoids.—Brunner Mond & Co., Ltd.
Wheatstone instrument parts.—Elliott Bros., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables, &c.—British Insulated & Helsby Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; Henley's Telegraph Works Co., Ltd.
Electrifying of crane.—Leeds Engineering and Hydraulic Co., Ltd.
Electric light fittings.—Mather & Platt, Ltd.
Electrical materials.—General Electric Co., Ltd.
Leclanché cells.—General Electric Co., Ltd.
Switchgear.—Ferguson, Pailin & Co., Ltd.; A. Reyrolle & Co., Ltd.
Telephones and telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.
Telephones.—Western Electric Co., Ltd.
Telegraph material.—Bullers, Ltd.
Telephone material.—Siemens Bros. & Co., Ltd.
Telegraph line wire.—Siemens Bros. & Co., Ltd.
Water-cooling tower.—Premier Cooler & Engineering Co.
Welding plant.—Quasi-Arc Co., Ltd.
Copper wire.—Shropshire Iron Co., Ltd.
Copper line wire.—Wilkes, Sons & Mapplebeck, Ltd.

H.M. OFFICE OF WORKS.

Engineering services.—Acton, Ministry of Pensions, electric lifts, &c.; Hammond Bros. & Champness, Ltd. Benenden Sanatorium, electric wiring: Bowden, Higlett & Co. Leeds, supply of electrical labour-in-daywork: Alpha Manufacturing Co. National Physical Laboratory, electric storage battery: Premier Accumulator Co., Ltd. Royal Mint, alterations to motors, &c.: Waygood-Otis, Ltd.

New Zealand.—AUCKLAND.—The list of tenders given in our last issue under the heading "Wellington" was, in actual fact, a list of estimates received and accepted by the *Auckland* City Council.

Salford.—Electricity Committee. Accepted:—

L.p., paper-insulated, lead-covered cable, £680.—W. T. Glover & Co., Ltd.
D.c. ironclad switchboard, £225.—Dorman & Smith, Ltd.

FORTHCOMING EVENTS.

British Science Guild.—Wednesday, June 8th. At the Goldsmiths' Hall, Foster Lane, E.C. At 3 p.m. Annual meeting.

Institution of Electrical Engineers (Wireless Section).—Wednesday, June 8th. At the Institution, Victoria Embankment. At 6 p.m. Paper on "Electric Oscillations along Straight Wires and Solenoids," by Prof. J. S. Townsend.

Physical Society of London.—Friday, June 10th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Lecture on "The Stability of Atoms," by Sir E. Rutherford, F.R.S.

NOTES.

X-Ray Heroes Honoured. — The committee of the Carnegie Foundation has awarded a gold medal to Dr. Infroit, a famous radiologist, who has had several fingers amputated as the result of disease contracted in the course of his X-ray experiments; a gold medal and £1,100 to M. Vaillant, head of the X-ray laboratory at the Salpetrière Hospital, who has continued his work in spite of losing his left arm; and a gold medal to the late Dr. Leray, who died on March 26th from burns contracted during his work in radiology.—*Reuter's Trade Service* (Paris).

Junior Institution of Engineers.—A dinner in celebration of the thirty-seventh anniversary of the Institution's foundation was given at the Café Monico, Piccadilly Circus, on May 26th, when the president, Lord Weir of Eastwood, presided over a company of nearly 100 members and guests; during the evening, Miss Winifred Mansfield and Mr. Roland Merry contributed humorous songs and stories, and Mr. Spencer Shaw, L.R.A.M., acted as accompanist.

Besides the Institution's headquarters in London, there are six provincial local sections and two abroad, one at Melbourne (Australia) and the other at Assam (India); the total membership stands at 2,169 of all classes, comprising engineers of all ages, from 18 upwards, who are engaged in the technical and administrative departments of engineering firms, &c.

Following the loyal toasts, Mr. Loughnan St. L. Pendred proposed "The Institution," in a humorous speech, which was much appreciated, and Mr. B. E. Dunbar Kilburn, M.A., in responding, referred to the work of the Institution and the keenness of all members. The toast of "Progress in Engineering" had coupled with it the name of Lord Weir (president and member of the Institution), and was proposed by Mr. C. H. Wordingham (president-elect of the Institution). "Kindred Institutions" was proposed by Mr. S. E. Fedden (president of the Sheffield Section) and replied to by Captain H. Riall Sankey—and thereby hangs a tale. A vote of thanks to the chairman, proposed by Lieut.-Col. A. E. Le Rossignol, brought the proceedings to a close.

Educational.—EXCHANGE OF PROFESSORS.—There has been for some time a regular annual exchange of professors between individual universities in France and America in regular academic fields, but not hitherto in engineering or applied science. These subjects are taught in France under special faculties, not included in existing exchanges with America, and the French methods of teaching them are unlike the American methods, for various reasons. Arrangements have now been made whereby seven United States universities have agreed with the French University Administration upon the annual exchange of a professor. The French selected for their first representative Prof. J. Cavalier, Rector of the University of Toulouse, and a well-known authority on metallurgical chemistry, and the American universities have selected as their outgoing representative for the year 1921-22 Dr. A. E. Kennelly, Professor of Electrical Engineering at Harvard University and the Massachusetts Institute of Technology. It is anticipated that if the plan continues to operate as favourably as it has commenced, there should not only be a steady annual exchange of a professor in various branches of applied science, but also a steady interchange of advanced students between France and America.

Service Notes.—In connection with the Defence Force, the following temporary appointments have been made:—London Electrical Engineers: Lieut.-Col. A. E. Le Rossignol, C.B., T. D.; Captains H. K. B. Reed, T. W. G. Ackland, I. S. Macadam, O.B.E., T. C. Mann, M.B.E., and E. Matthews; Lieutenants G. St. J. Sugg, C. G. Huntley, H. F. Cousins, W. J. Rawlings, A. B. Penney, L. B. Foster, G. O. King and A. W. King; Quartermaster and Captain S. W. P. Goodwin—all war veterans. Tyne Electrical Engineers: Lieut.-Col. E. Robinson, M.B.E., T.D., Major H. E. Burton, O.B.E., Captain C. M. Foster, Lieutenants C. B. Williamson, R. P. Winter, M.C., E. H. E. Woodward, M.C., R. Sharp, O.B.E., C. F. Fawcett; Captain and Quartermaster A. Reed. Since being gazetted as above, Lieuts. R. Sharp and Woodward, Tyne Electrical Engineers, have been promoted Captains. Capt. W. H. Pay and Lieut. W. B. Davies have been posted to the Electrical Companies of the Defence Force. Recruiting for the electrical branches of the Navy and Army is very satisfactory, the increased pay and better service conditions attracting a good class of recruits.

Electricity in Farming.—At the Oxfordshire Agricultural Show, held at Banbury from May 24th to May 26th, electrical appliances were well to the fore, showing that electricity is fast coming to be recognised as a powerful agent in successful farming.

MESSRS. J. BUSTIN'S ELECTRICAL WORKS, Banbury, who specialise in electric light installations in country houses, mansions and public buildings, had on show a fine range of self-contained electric-lighting and power plants, consisting of Crossley engines driving generators. One direct-coupled electric-lighting set, manufactured by MESSRS. DIXON BROS. & HUTCHINSON, was used for lighting the stand and advertising novelties. A small "Aster" lighting set, and also a good show of their own manufactured switchboards, suitable for country house installations, appeared on the stand. Both stationary and portable types of Crossley engines driving pumps and farm machinery were shown. There was also an "Albany" electrically-driven, direct-coupled pump, an electrically-driven churn, a washing machine, and a range of farm machinery driven by separate electric motors, showing the advantages of electric drive. "Skefco" roller bearings for an electric clipping machine and several small electric motors were also exhibited.

The domestic appliances on show consisted of electric fans, kettles, irons, hotplates, vacuum cleaners, and many other labour-saving devices; the electric kettles were used for making tea which was very much appreciated by the many inquirers who commented on the quickness and cleanliness of electricity. A large amount of interest was caused by the "Mystic" Electric Sign advertising Osram Lamps, which was kindly loaned by the General Electric Company. "Exide" Batteries for lighting and self-starting sets for motor cars, and battery charging boards were also included.

MESSRS. J. MAWLE & SONS, of Banbury, also exhibited lighting and power plant.

X-ray Research.—TREATMENT OF CANCER.—Dr. A. E. Barclay, medical officer in charge of the X-ray Department of the Manchester Royal Infirmary, has received through an anonymous donor a gift of £4,000 in aid of research work in connection with "intensive X-ray therapy." The donor has expressed a wish that a portion of the money should be utilised in paying the expenses of a scholar who is to proceed to the Continent to study the methods adopted in various clinical centres, *e.g.*, Erlangen, for the utilisation of intensive X-ray therapy in relation to the treatment of cancer, says the *Manchester Guardian*. The Board of Management of the Royal Infirmary has accepted the gift, and made arrangements to have the necessary apparatus installed in the X-ray department. Dr. Anderson has been appointed Research Scholar, and will proceed to the Continent in July. A Committee consisting of Sir William Milligan (chairman), Dr. A. E. Barclay, Prof. Bragg, Dr. Arthur Burrows, Prof. Dean, Prof. Hill, and Mr. James Watts, junior, has been appointed to complete the necessary arrangements and to administer the fund. The intention of the donor is to stimulate inquiry into a recently-suggested means of dealing with malignant disease—a method which has caused considerable stir in medical quarters on the Continent.

Appointments Vacant.—Two junior clerks (£70 + war bonus = £185) for the St. Pancras B.C. Electricity Department; foreman armature winder (Rs. 450 per month) for the North-Western Railway of India Electrical Department; assistant lecturer in Electrical Engineering (£200 + war bonus = £433), for the Belfast Municipal Technical College; electrical engineer for the Ludlow Electric Light Works; lecturer in Electrical Engineering (salary, including bonus, £520) for the Bradford Technical College; meter reader and fixer for the Hackney Borough Council Electricity Department; assistant in electrical technology (Rs. 625 + per mensem) for the Indian Institute of Science, Bangalore. See our advertisement pages to-day.

Fatalities.—An inquest was held on May 23rd, at Plymouth, to inquire into the cause of the death of Fred. Langford, a wireless operator, who was killed at the Cattewater Air Station by an explosion. Sergeant Fred. Coombes, who is in charge of the wireless station, in giving evidence, said the accident was caused by a spark which ignited the celluloid container of an accumulator. The flame set alight Langford's clothing, which was saturated with oil, and an explosion resulted. A verdict of "Death from natural causes was returned," and the Coroner highly complimented Corporal Scott, who endeavoured to reach the power house after the explosion. Scott tied a towel over his head, broke down the door, and tried to drag the man away.

At Huddersfield, on May 28th, a verdict of "Accidental death" was returned in the case of Tom Buckley, whose body had been found in an electric hoist at the works of Messrs. Gledhill Bros. and Co., Ltd., where he was employed. The evidence indicated that he had touched a broken switch, and had died from electric shock.

London Engineers' Club.—The proposal to have an engineers' club situated in London, to serve the needs of British engineers throughout the world, is now coming rapidly to a head. In fact, we may say it has come, for a general meeting of the supporters of the club was to be held yesterday, at the Hotel Cecil, with Mr. E. Manville, M.P., M.I.E.E., &c., in the chair, at which resolutions inaugurating the club on regular lines were to be put forward. Over 1,600 applications for membership have already been received, and these are being added to daily. Applications are coming not only from London and the provinces, but also from Australia, New Zealand, India, South Africa, South America, Canada, Egypt, and the United States, as well as from Norway, Sweden, Denmark, Belgium, Holland, France, Spain, and Italy. It is hoped very shortly to acquire first-class premises in a central situation in London, and there is every prospect of the club's starting in the summer of this year. If a census could be taken on any day in the year, it would probably be found that some 800 to 1,000 British engineers from overseas were in London without any place to call their home, and the Engineers' Club will not only fill this want, but will also serve as an Engineering Exchange for the British Empire. The subscriptions proposed are ten guineas for town members, five guineas for country members, and two guineas for overseas and foreign members. Full particulars can be obtained from the temporary Honorary Secretary, Mr. Edmund L. Hill, 39, St. James's Street, London, S.W. 1.

A Blind Engineer's Invention.—Mr. Gamble, who prior to the war was electrical engineer to a suburban Corporation, after occupying a number of important posts in the Ministry of Munitions, was employed as chief electrical engineer to the National Steam Car Co., which was engaged in the production of war *matériel*. While carrying out his duties, the bursting of a coal calorimeter deprived him of the sight of both eyes, and he was compelled to abandon his profession. Through the kindness of Sir Arthur Pearson, Mr. Gamble was able to enter St. Dunstan's, where he received training in secretarial duties.

The blinded engineer set about devising a means of overcoming the difficulties of typewriting, and the device which he evolved is shown in the accompanying illustration.

The actual keyboard is memorised, and to help, a Braille scale is fitted to the carriage of the machine in place of the ordinary printed scale which is seen on every typewriter. This scale is fitted with "stops" which operate the bell and give warning when the end of the horizontal line is reached. The chief difficulty, however, was found in easily determining when the end of the paper was being reached, and in doing tabular matter, as well as in taking out a document and reinserting it in exactly the same position. Some audible warning was obviously necessary, and the attachment shown in the illustration (for which letters patent have been applied

for) gives this. It is made from an aluminium stamping, flanged at each side, and is trough shaped in section. Down the trough works a flat clock-shaped spring, its upper end being wound round the wheel at the top. To the lower end of the spring is fixed a clip somewhat after the shape of the office "bull-dog" clip, only instead of a spring to close the jaws, there is a screw, so that the top end of the paper can be inserted by the operator with the full use of both hands. On the clip is a projection for obtaining absolute squareness of the paper, and a tiny point sticks in the paper for determining the exact position, should the letter have to be taken out and reinserted in the machine. With the spring, and its clip holding the paper, typewriting can proceed in the usual way, and when the end of the paper is being approached the clip above referred to touches another stop with suitable trip-levers, to operate the bell which is shown on the right. The stops and clip are adjustable so that the exact position, working from top to bottom, can always be arranged for, thus permitting tabular matter to be done perfectly. Braille characters (marked out in inches) are stamped at the side, so that the parts can be adjusted according to the actual length of matter required.

We are indebted to Mr. Pringle, of 140, Bishop's Road, Chelmsford, for this description and the photograph.

Popular Science!—From time to time we have had occasion to comment upon wildly exaggerated statements put forward by the non-technical Press in connection with new discoveries and inventions, as well as in connection with things that are neither.

The latest example of this recently appeared in the *Daily Mail* in what purported to be a description of the re-discovery of electrostatic attraction between a semi-conductor and a "good" conductor by Messrs. Johnsen and Rahbek, whose relay, according to the *Daily Mail*, which quotes Mr. Thorne Baker in support of its theory, is "the nearest approach yet seen to the unsolvable problem of perpetual motion." We cannot think that this is what Mr. Thorne Baker really said.

At the demonstration the inventors displayed a small electroscopic detector about the siz of an ordinary fountain pen. This is apparently the instrument which leads the *Daily Mail* to think that "it is no exaggeration to say that their new relay makes it possible to have a portable wireless receiving set little bigger than a fountain pen." There are other statements which require to be taken *cum grano salis*, but we will merely disagree with the idea that the new discovery is "more remarkable" than the invention of the amplifying valve.

Whiteley Village.—By means of a bequest of one million pounds left by the late Mr. William Whiteley, the Whiteley Village, providing homes for aged persons, has been built in a beautiful park near Walton-on-Thames; it will ultimately provide accommodation for upwards of 500 villagers, the population at present numbering 281. On May 28th it was visited by the King and Queen, who were received by the trustees of the estate.

Electric lighting has been provided throughout the estate, the supply being derived from the Urban Electric Supply Co., Ltd., Weybridge. The road lighting is controlled by Venner time switches. The main cables were made and laid by the B.I. and Helsby Cables, Ltd.; the house services and road lighting cables are C.T.S. laid in g.i. screwed tubes. Interior wiring is of v.i.r. cable in screwed conduit. The principal contractors were:—For wi ing the buildings, and service cables, Messrs. Pinching and Walton; wiring the large hall, Messrs. Duncan Watson & Co.; wiring the church, Messrs. Drake & Gorham, Ltd.; fittings and lamps, Messrs. William Whiteley, Ltd.; main switchboard (by Mr. Cecil Hodges), Messrs. Malcolm & Allan; 20-line telephone exchange and stations for the use of the staff, Western Electric Co., Ltd., installed by Messrs. Duncan Watson; electric bells and road lighting cables, Messrs. H. J. Cash & Co.

The church organ blower is driven by a motor which is controlled by an automatic device devised jointly by the consulting engineer, Mr. H. D. Wilkinson, M.I.E.E., M.I.Mech E. (who was responsible for the whole of the engineering installations on the estate), and the resident engineer, Mr. J. Hetherington.

Electrostatic Adhesion.—The earliest discovery of the phenomenon which Messrs. Johnsen and Rahbek have re-discovered appears to have been made by Elisha Gray. It was recorded in The Telegraphic Journal of September 1st, 1877, in an article by W. H. Preece (afterwards Sir W. H. Preece), as follows:—

"Elisha Gray, of Chicago, in 1873, succeeded in producing tones from the finger when rubbing a dry sonorous body, such as an ordinary tin can, while the intermittent currents sent by a vibrating tuning fork were passing through it, and by attaching an electromagnet to a hollow sounding box, open at one end and closed at the other, he was able to reproduce exactly the *tones* of the musical notes transmitted. His electromagnet had its armature rigidly fixed to one pole, and separated from the other by a space of one-sixtieth of an inch. He called it a *resonator*. The vibrations of this armature were imparted to the sounding box and became thereby magnified."

INSTITUTION NOTES.

Institution of Electrical Engineers.—The results of the recent elections having been announced at the meeting held on May 26th, we are now able to give a list of the officers and Council of the Institution for the session 1921-22. The list, of course, is in addition to past-presidents. The names of those newly elected are given in italics.

President.—J. S. Highfield.

Vice-Presidents.—Dr. W. H. Eccles, A. A. C. Swinton, *Prof. E. W. Marchant*, D.Sc., *C. C. Paterson*, O.B.E.

Hon. Treasurer.— Sir James Devonshire, K.B.E.

Ordinary Members of Council.—H. J. Cash, *Lieut.-Col. Cortez-Leigh*, J. R. Cowie, *S. Evershed*, S. E. Fedden, E. A. Gatehouse, F. Gill, P. V. Hunter, C.B.E., A. H. W. Marshall, Sir W. Noble, Sir A. M. Ogilvie, K.B.E., C.B., *A. Page*, *T. Roles*, Dr. A. Russell, A. W. Tait, C.B.E., P. D. Tuckett, C. Vernier, B. Welbourn.

In addition to the above, we give, as far as we are able, the chairmen-elect and immediate past-chairmen of Territorial and Colonial Centres (chairmen in italics):—

N.E.—*Prof. W. M. Thornton*, D.Sc., and J. R. Beard, M.Sc.
N.W.—*Ald. W. Walker* and J. Frith.
S. Midland.—F. Forrest.
N. Midland.—*W. E. Burnand* and C. J. Jewell.
Irish.—*R. W. Eaton* and A. G. Bruty.
Scottish.—*E. T. Goslin* and J. E. Sayers.
Hong-Kong.—F. Graham.
Cape Town.—W. F. Long.
Calcutta.—J. W. Meares.

Annual General Meeting.—The forty-ninth annual general meeting of the Institution was held in the I.E.E. building, on Tuesday last, when the President, Mr. Ll. B. Atkinson, introduced the Council's report for the 1920-21 session, which was abstracted in our last issue. In briefly touching on the more important points, Mr. Atkinson said that they had been hardly able to trace any loss of members consequent upon the recent increase in subscription. The report and accounts were adopted, and a vote of thanks to the Institution of Civil Engineers for the facilities it put at the disposal of the I.E.E. for nearly five years was carried, as was also a vote of thanks to the hon. officers of the Institution at home and abroad. Messrs. Allen & Attfield were re-elected auditors. The meeting then terminated.

The Charter.—A special meeting was then held, at which the President introduced the subject of the Royal Charter which the Institution is to ask the Privy Council to grant, and explained that a postcard vote had been taken; 63·5 per cent. of the corporate members had voted, all except three being in favour of the proposal. After Mr. R. T. Smith had seconded the resolution proposing to seek the charter, and Mr. C. H. Wordingham had explained the work he had done in connection with the subject, the motion was put to the meeting, and carried unanimously.

LECTURE.—Afterwards an ordinary meeting was held, to hear a lecture on "Research Work in the United States," by Dr. F. B. Jewett, chief engineer of the Western Electric Co., which, said the President, had the largest research laboratories in the world. Dr. Jewett was severely handicapped by the non-arrival of a number of lantern slides which were to have illustrated his lecture, but he substituted an extemporaneous discourse on the development of research in the United States, which was heard with deep interest. He expressed some doubt whether industrial research had not been overdone; people were expecting too much from it, and when the dollars failed to roll in, there might be a reaction. The National Research Council, formed with the aid of the National Academy of Sciences, was founded to carry out war work, which it did very effectively; it was now being reorganised for peace purposes, and covered the whole field of science, each division being provided with a chairman, who was paid an adequate salary. The Engineering Foundation had joined forces with it, and became the Engineering Division. The function of the National Research Council, which was not a Government institution, was to stimulate research in the industries and to provide funds for the purpose; it had some $200,000 a year at its disposal, provided by the Engineering Foundation and the industries. Men of recognised ability were granted fellowships worth from $1,800 to $2,500 a year to carry on research. Particulars were given of some typical researches, to which the industries contributed large sums of money. A research on the fatigue of metals was particularly successful, and while the big firms would not co-operate in a research on electrical insulation, they readily supported the National Research Council with funds to prosecute the investigation. Private research laboratories were now thoroughly established, and able men were being trained for industrial research, not in technical colleges, but in universities. The big firms had their own laboratories; small ones combined for the purpose, and there were also consulting research laboratories. Sir Frank Heath then gave a full account of the organisation of the British Department of Scientific and Industrial Research, and compared its methods with those adopted in the United States. The meeting closed with votes of thanks to the speakers, proposed by Mr. C. H. Wordingham and Mr. C. C. Paterson.

WIRELESS SECTION COMMITTEE, 1921-22.—The following members have been nominated to serve on the Wireless Section Committee, 1921-22:—Chairman: Dr. G. W. O. Howe. New nominations for membership of the Committee: Mr. B. Binyon, O.B.E., Dr. W. H. Eccles, G. H. Nash, C.B.E., and C. C. Paterson, O.B.E. The following will continue to serve as members of the Committee: Sir Charles Bright, F.R.S.E., Mr. R. C. Clinker, Prof. C. L. Fortescue, Mr. A. Gray, Admiral of the Fleet Sir H. B. Jackson, G.C.B., Captain H. J. Round, M.C., Messrs. A. A. C. Swinton, F.R.S., and L. B. Turner.

SUMMER MEETING.—The secretary of the Institution informs us that, in view of the continuance of the coal miners' strike, the Scottish Committee has been reluctantly compelled to cancel the proposed Summer Meeting, which was to have been held in Scotland next week.

ELECTROSTATIC ADHESION.—On May 26th Messrs. Alfred Johnsen and Knud Rahbek demonstrated the phenomenon of adhesion between the surfaces of a semi-conductor and a good conductor when a potential difference is applied to them. This was outlined in our issue of May 20th. Their first experiment, performed by means of a balance to one side of which a brass disk was suspended in contact with a slab of lithographic stone, showed that when a potential difference of 440 volts was applied, the adhesive force was in excess of 500 grammes.

The most useful form of apparatus constructed to make use of the principle consisted of an agate or flint cylinder, mechanically rotated, over which was fitted a metal band held in position by springs. This arrangement was put into a circuit as a relay, when a series of electrical impulses caused corresponding movements of the band. In this way it was possible to record the receipt of telephonic or telegraphic impulses, as well as wireless waves. An application of this apparatus demonstrated by the inventors took the form of a stringless violin, which was made to serve the purpose of a loud-speaking telephone, amplifying the impulses set up in a telephone circuit by a violin played in another room. Speech was also transmitted in this way. Another application, shown in action by means of a shadow outline thrown upon a screen, was a small electroscope about the size of an average fountain pen, which can be used to test whether conductors are "live" or not.

Iron and Steel Institute.—The autumn meeting will be held, by invitation of the Comité des Forges de France, in Paris, on September 5th and 6th.—*The Times.*

British Science Guild.—The annual meeting of the Guild will be held at the Goldsmiths' Hall, on Wednesday, June 8th, at 3 p.m. The speakers will be: The Right Hon. Lord Montagu of Beaulieu, K.C.I.E., C.S.I.; the Very Rev. William R. Inge, C.V.O., on "The Road to Ruin and the Way Out"; and Sir Richard A. S. Redmayne, K.C.B., on "The Importance of Research in Promoting the Development of the Mineral Industries." Cards of Invitation may be obtained on application to the Secretary, British Science Guild, 6, John Street, Adelphi, W.C. 2.

Physical Society of London.—At the meeting held on May 13th, a paper, entitled "Notes on Vacuum Tubes used as Detectors of Electrical Oscillations," by Messrs. Hartshorn and E. S. Keeping, was read by the former. The paper describes the development of a robust form of vacuum tube which was used as a detector of electrical oscillations in the "wireless" circuits carried by aeroplanes. Platinum electrodes are avoided, being replaced by strips of tinfoil, to which contact may be made by the spring clips holding the tube in position. It is found that when a discharge is passed through such a tube, the walls are affected in such a way that thenceforth it is much easier to get a discharge to pass. The change produced by the first discharge is annulled by heating the tube above 210° C. Further, if the walls are coated on the inside with a metallic film, this first discharge is unnecessary, and the tube is unaffected by heating, but when the walls are coated with an insulator, it is, if anything, more difficult to pass a discharge. A silica tube behaves like one coated with metal. It seems possible that the change in the tube may be due to the formation of a layer of gas molecules on the walls by the first discharge. The explanation of the behaviour of the silica tube is difficult.

Association of Mining Electrical Engineers.—At the annual meeting of the West of Scotland Branch of the Association, held in Glasgow, Mr. Frank Analow, who presided, announced that the membership now exceeded 300. Office bearers were elected for the ensuing session; Mr. F. J. Jamieson was elected president. A paper by Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, on "Surface Electrical Equipment at Mines, as Affected by the Regulations of July, 1920," was read and discussed.

The Franklin Institute.—On May 18th, at a meeting of the Institute, a certificate of honorary membership was presented to General Pershing. The Franklin Medal and a similar certificate were presented to the French Ambassador for Prof. Charles Fabry, of the University of Paris. A similar honour was paid to Mr. Frank J. Sprague, of New York. The paper read on behalf of Prof. Fabry was entitled "Studies in the Field of Light Radiation." Mr. Sprague presented a review of the progress of electric traction.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Darwen Town Council has decided to increase the salary of MR. FLETCHER, electrical engineer, by £100 a year; and that of MR. NEWHOLME, tramway manager, by £50 a year, with a further £25 in each of the next two years.

MR. C. WILLIAM SKINNER, a member of the staff of the I.E.E. from 1912 to 1919, and now with Mr. Fredk. A. Grant, F.A.I., was first in order of merit at the recent examinations of the Auctioneers' Institute, receiving the silver medal, the Institute and Branch prizes, and was also successful at the Intermediate Examination of the Surveyors' Institution.

Messrs. Malcolm & Allan, Ltd., electrical power and lighting contractors, inform us that their London manager, Mr. H. S. Davidson, is now no longer in their employ. MR. H. FRANCIS SMITH, who has been engaged as their London technical manager, was for many years in the employ of Messrs. J. G. White & Co., in South America. MR. H. S. BUTLER will continue as commercial manager of their London branch.

MR. HUGH S. DAVIDSON, late London manager for Messrs. Malcolm & Allan, Ltd., has now joined the staff of Mr. Stanley Johnston, engineer, of 7-9, Queen Street, Belfast, in a similar capacity.

Halifax Tramways Committee recommends the granting of an honorarium of £300 to MR. J. W. GALLOWAY, tramway engineer, in recognition of extra services rendered by him in connection with the management of the undertaking during the illness of the manager, and pending the appointment of the new general manager.

MR. E. W. DOREY has opened offices at Norwich House, Southampton Street, W.C. 1, where he is specialising in the installation of apparatus for the improvement of power factor.

MR. P. O. WILLMOTT, after 15 years with Messrs. Robt. W. Blackwell & Co., Ltd., for the last 12 as purchasing agent and sales manager, has resigned his position, and will start in business handling similar lines, with his colleague and assistant, MR. F. S. C. PHILLIPS, who has also resigned from Messrs. Blackwell's service. For the present, letters should be addressed to 13, Alexandra Park Road, London, N. 10.

The *Times* announces that SIR EDMUND WYLDBORE-SMITH has accepted the post of chairman of the Metropolitan Carriage, Wagon and Finance Co.

MR. G. BOORMAN, manager of the Electrical Department of Messrs. Albert Lee & Co., Ltd., London, E.C., informs us that he has resigned his position as from May 31st.

The *Daily Telegraph* states that MR. ALEXANDER MOIR, O.B.E., superintending engineer of the London District of the Post Office, is about to retire after nearly 47 years' service. On Tuesday last Sir William Noble the Engineer-in-Chief, presented Mr. Moir, on behalf of the staff of the district, with a grandfather clock, and Mrs. Moir with a diamond brooch.

MR. W. J. MATHEWS, 74, Greenway Avenue, Taunton, late sales manager of Messrs. Newtons, Ltd., has been appointed sole agent of the Electric Construction Co., Ltd., for the South-West of England.

MR. L. W. GEORGE, chief assistant at the Horsham Urban District Council electricity works, has been appointed to a similar position in the Aldershot Urban District Council's electricity department.

A correspondent is anxious to get into communication with Major Pope, R.E., ex-O/C. 34th (Eastern) Division Signal Company, R.E., who returned to South America after the war.

Obituary.—Mr. E. L. Orde.—We regret to record the death, which occurred suddenly in London, on May 27th, of Mr. Edwin Lancelot Orde, ex-President of the North-East Coast Institution of Engineers and Shipbuilders and a director of Armstrong, Whitworth & Co., Ltd., of Newcastle-on-Tyne. Mr. Orde was 58 years years of age. He was greatly interested in the use of oil fuel for sea-going vessels.

Mr. E. Brown.—The death took place on May 23rd, at the age of 36 years, of Mr. Ernest Brown, who had for 16 years been on the staff of the Northampton Electric Light Co. For the past eight years he had been foreman of the wiring department.

NEW COMPANIES REGISTERED.

Lancashire Industries, Ltd. (174,761).—Private company. Registered May 18th. Capital, £1,000 in 900 ordinary shares of £1 each and 200 ordinary shares of 10s. each. To carry on the business of electrical engineers, factors of and dealers in electrical and mechanical appliances, shippers, warehousemen, clothiers, leather merchants, importers, exporters, and agents, &c. The subscribers are: F. W. Roberts, 11, St. Oswald Street, Manchester, electrical engineer; E. Tracey, 10, Argyle Avenue, Victoria Park, Manchester, secretary; J. Moorland, 6, Tennis (?) Street, Old Trafford, Manchester, director. The first directors are: F. W. Roberts, E. Tracey, and H. D. Barker. Qualification: Twenty ordinary shares. Registered office: 63, Cannon Street, Manchester.

Lift & Engineering, Ltd. (174,800).—Private company. Registered May 20th. Capital, £5,000 in £1 shares. To carry on the business of manufacturers and constructors of and dealers in lifting and hoisting machinery, contractors, electrical, mechanical and general engineers, machinists, fitters, founders, &c. The subscribers (each with one share) are: W. G. Clark, 2, Hill View Road, Orpington, Kent, insurance official; H. F. C. Smith, 65, New Bond Street, W.1, engineer. The first directors are not named. Registered office: 4, Tokenhouse Buildings, King's Arms Yard, E.C.2.

H. J. Harding, Ltd. (174,831).—Private company. Registered May 23rd. Capital, £8,000 in £1 shares. To carry on the business of motor, electrical, and general engineers as formerly carried on as "H. J. Harding," at Low Row, Sunderland. The first directors are: H. J. Harding (permanent managing director), 98, Elmwood Street, Sunderland; F. W. Douds, 57, Dundas Street, Sunderland; J. R. Smith, 40, Church Street, Deptford, Sunderland. Secretary: J. R. Smith. Registered office: Low Row, Sunderland.

Lacy-Hulbert & Co. (1921).—Private company. Registered May 20th. Capital, £40,000 in £1 shares. To carry on the business of pneumatic and general, mechanical, and electrical engineers, machine, tool, and motor makers, vacuum cleaners, boiler makers, makers of air compressors, vacuum pumps, and other pneumatic machinery, iron, brass, metal, and other founders, smelters, refiners, engineers, &c., and to adopt an agreement with Lacy-Hulbert & Co., Ltd. (incorporated in 1903). The first directors are: C. E. Lacy-Hulbert, Morden Grange, Mitcham, Surrey; A. G. London, Oakleigh Lodge, Sunbury, Middlesex; D. G. Halsted, no address given. Registered office: Boreas Works, Beddington, Croydon, Surrey.

Tidd, Siday & Co., Ltd. (174,902).—Private company. Registered May 26th. Capital, £20,000 in £1 shares. To carry on the business of electricians, engineers, telephone and scientific instrument manufacturers, chemists, manufacturers of perfumes, disinfectants, deodorant and chemical preparations, &c., and to adopt an agreement with W. E. Siday. The first directors are: J. T. Tidd, 22, St. Stephen's Avenue, West Ealing; W. E. Siday, 43, St. Helens Gardens, North Kensington; H. S. Grimston, 161, Grosvenor Road, Ilford; H. Buss, 341, Ivydale Road, Peckham Rye, S.E. The two first-named are permanent. Qualification: £100. Registered office: 180, Drury Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Jones, Burton & Co., Ltd.—Mortgage dated May 11th, 1921, to secure £5,000 charged on certain land and buildings in Liverpool. Holder: G. L. Burton, 16, Victoria Street, Westminster.

Simms Motor Units (1920), Ltd.—Land Registry charge on "The Grange," East Finchley, dated May 4th, 1921, to secure £40,000. Holders: W. E. Martin, The College, Maidstone, and E. J. Townsend, Tynwald, Packhorse Road, Gerrards Cross, Bucks. (trustees of prior deed securing £40,000 mortgage debentures).

Altrincham Electric Supply, Ltd.—Debenture dated May 13th, 1921, to secure £32,000 charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders: London County Westminster & Parr's Bank, Ltd.

W. H. Dorman & Co., Ltd.—Deposit on May 2nd, 1921, of deeds of certain lands and premises in Stafford, to secure all moneys due or to become due from company to Lloyd's Bank not exceeding £10,000 (in addition to £40,000 secured by prior charge).

Pontelec Welding Patents, Ltd.—Return dated January 6th, 1921. Capital, £30,000 in £1 shares (20,000 ordinary and 10,000 preference). 20,000 ordinary and 5,000 preference shares taken up. £5,000 paid, £20,000 considered as paid. Mortgages and charges: £2,000.

Notting Hill Electric Lighting Co., Ltd. (25,921).—Return dated March 29th, 1921. Capital, £201,352 10s. in 17,002 6 per cent. non-cumulative preference and 2,998 6 per cent. cumulative preference shares of £10 each and 27,050 ordinary shares of 1s. each. 11,402 non-cumulative preference, 2,998 cumulative preference, and 27,050 ordinary shares taken up. £145,352 10s. paid. Mortgages and charges: £64,000. Also guaranteed by this company and the Kensington & Knightsbridge Electric Lighting Co., Ltd., and issued under the powers of the Kensington & Notting Hill Electric Lighting Companies Act, 1899: £221,550.

Telegraph Construction & Maintenance Co., Ltd. (11,47C).—Return dated March 24th, 1921. Capital, £886,400 in £12 shares. All shares taken up. £448,200 paid. £448,200 considered as paid. Mortgages and Charges: Nil.

London Electric Supply Corporation, Ltd. (24,957).—Capital, £1,300,000 in 300,000 ordinary shares of £3 each and 90,000 preference shares of £5 each and £250,000 to be divided into preference or ordinary shares as the board may determine. To March 7th, 1921, 111,000 ordinary and 89,840 preference shares had been issued and £782,200 paid thereon. A further £160 had been paid on 160 shares forfeited. £587,355 debenture stock was outstanding.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Capital, £800,000 in 70,000 6 per cent. cumulative preference and 50,000 ordinary shares of £5 each, of which, to February 17th, 1921, 46,261 preference and 40,977 ordinary had been taken up. All credited as fully paid (total £436,190). £272,373 4½ per cent. first debenture stock was outstanding (part of £400,000 authorised).

Newmarket Electric Light Co., Ltd. (44,450).—Capital, £30,000 in £10 shares. Return dated April 4th, 1921. 2,656 shares taken up. £26,560 paid. Mortgages and charges: £14,200.

Newcastle & District Electric Lighting Co., Ltd. (28,022).—Capital, £300,000 in £10 shares. Return dated March 25th, 1921. All shares taken up. £297,500 paid, leaving £2,500 in arrears. Mortgages and charges: £303,100.

New Development Co., Ltd. (112,145).—Capital, £5,000 in £1 shares. Return dated March 30th, 1921. 1,275 shares taken up. £1,275 paid. Mortgages and charges: Nil.

CITY NOTES.

Anglo-Argentine Tramways Co., Ltd.

The gross receipts for 1920 were £4,413,165, less expenditure £3,198,028. Including £44,513 interest received and transfer fees, there is £1,259,650 available. From this there is deducted £70,660 annuity to City of Buenos Ayres Tramways Co. (1904), Ltd., £587,821 interest and sinking funds for debenture stocks, and £7,295 sinking fund for redemption of preference and ordinary shares, leaving £593,875, plus £175,510 brought forward. The following distributions were paid during the year in satisfaction of all the arrears and current dividends on the 5½ per cent. first preference shares: July, 1920, dividend for year to June 30th, 1918, £176,000; October, 1920, dividend for year to June 30th, 1919, £176,000; December, 1920, dividend for 18 months to December, 1920, £264,000; total £616,000. The directors now recommend the payment of a dividend of 5½ per cent. on the second preference shares in satisfaction of the arrears to December 31st, 1916, £137,500; leaving to be carried forward £15,884. £133,172 has been allocated out of revenue to the general renewals fund, against £97,000 in 1919, the additional provision being considered desirable in view of the high cost of materials. The number of miles open for traffic was 395½, the actual mileage run during the year being 61,303,692, and the number of passengers carried 432,636,355. The traffic receipts received the benefit of the revised fares from April 10th, 1920, and show an increase of £886,981. The increase is equal to 28.36 per cent. The working expenses were 75.60 per cent., as compared with 79.91 per cent. in 1919. Traction expenses were £52,970 lower than the previous year, due to decrease in cost of fuel. The death is reported of Monsieur G. de Laveleye, president of the Banque de Bruxelles, who had been a director of the company for nine years. On his appointment as Parliamentary Secretary to the Board of Trade, Sir Philip Lloyd-Greame, K.B.E., M.P., relinquished his seat on the board, and the vacancy was filled by the appointment of the Rt. Hon. Sir Edward Goulding, Bart., P.C., M.P. The board record their appreciation of the services rendered by the members of the local committee, Mr. Pedriali, the general manager, Mr. Dawes, the London manager, and the staff both in the Argentine and London.

Mr. J. Pedriali, the general manager, reporting at length upon the undertaking, says that the year 1920 may be classified as a year which commenced full of promise and terminated in a disappointing manner. The post-war prosperity, which was world-wide, coupled with the excellent harvests and very high prices obtainable for all the produce of the country, had the effect of producing an extraordinary growth of activity during the first half of the year, but the slump in prices and consequent business stagnation which marked the reaction in Europe and the United States was not long in producing effects in Argentina, and towards the close of the year the crisis was acute. The immigration continues poor, and this, no doubt, is due in great measure to the unsettled state of affairs in Europe, the Argentine Republic not offering, on the other hand, at the present time, any special inducement to the labourer abroad. The work undertaken by the technical department (surface) during the year was exceptionally heavy. There are 43 fewer motor cars and 96 more convertible trailers in service than in the previous year. The number of breakdowns in the overhead installations show a still further improvement upon the results of the previous year, notwithstanding the fact that this year several exceptionally violent storms were experienced. The methodical unification of all materials and accessories, and the systematic inspection of the lines upon the basis of the actual traffic borne, have given excellent results in practice. During the course of the year the subway rolling stock was reinforced by the arrival from Europe of 31 motor cars, thus bringing the number of cars up to 120. The general passenger traffic for the year compared favourably with the corresponding returns of the previous year. In 1919 there was a serious strike lasting three weeks, which completely upset the normal passenger transport. In

1920 there was a general taxi-cab strike, which had a beneficial effect upon traffics; the increased revenue represented by this strike amounted to at least $7,000 to $8,000 paper per day. Then again in 1920 they had the 12 cent tariff from April 10th. The number of passengers carried during the year was 391,312,991, giving an average return of 4.19 passengers per car km. run. In 1919 the passengers carried amounted to 335,068,599, the average per car km. being 4.10 passengers. There was thus an increase of 16.8 per cent. in the total number of passengers carried in favour of 1920. The subway traffic receipts for 1920 compare very favourably with those of previous years. The number of passengers carried was 41,323,364, as compared with 35,666,386 in 1919, or, say, an increase of 15.86 per cent. The average number of passengers carried per car km. shows also an important increase, the figure for 1920 being 7.86, as against 7.69 in the previous year. The average receipts also show an important increase, the return per car km. being 90.5 cents, whereas in 1919 the average was 76.9 cents. For 266 days the receipts were benefited by the increased fare of 12 cents, and for the first 100 days the fare was at the old rate of 10 cents. In forecasting the probable increase from the altered fare it was roughly calculated that one million passengers per day would contribute the additional 2 cents, giving an increase of $20,000 per day. But this figure has been reduced by the largely increased sale of workmen's return tickets, issued at 10 cents for the double journey. The increase in passengers has been 16.7 per cent. and the increase in car kilometres run 14.4 per cent. The wages, taxes, and pension fund have taken $7,176,653, which has been met by the increased receipts. The cost of electricity has been less by $830,255. The difficulty in the middle of the year in procuring fuel affected very disadvantageously the cost of producing electricity. The fuel situation got worse in place of better, and in the latter months of the year 1920 energy cost more than in 1919. The net amount debited to capital account for the year was £567,333. The expenditure on renewals account was £82,011. As a result of the tariff question the company presented its scheme for the construction of the new 30 kilometres of track, which it had agreed to build within the next three years, and this scheme is now being studied in the municipality. Mr. Pedriali concludes as follows:—

"Although the increase in passengers of the year 1920 over 1919 surpassed the estimate given in my report for 1919, this cannot be attributed to a continuation of the flourishing situation during the whole year, but rather to the fact that, in calculating the effects of the application of the new 12 cent tariff I slightly over-estimated the losses of passengers we would have. The latter months of 1920 certainly gave signs of the recommencement of a commercial crisis, the direct result of the world-wide post-war reaction, which became acute in the first months of 1921, and still continues. This has affected our traffic, and is likely to continue doing so throughout the year, for the reasons given at the commencement of this report. All things considered, therefore, I think we cannot estimate an increase in receipts beyond 5 per cent. upon the year 1920. The great drop in prices of fuel will, however, favourably affect our working expenses, especially after the month of April, when the present stocks of coal at higher prices are exhausted."

At the meeting, on June 7th, a resolution will be submitted authorising the directors to borrow a temporary loan up to not exceeding £500,000 in the aggregate at any one time.

Barcelona Traction, Light & Power Co.

The *Financial Times* states that owing to adverse conditions, the company warns the 5½ per cent. first mortgage bondholders that it may not be possible to pay the increased rate of interest on December 1st next. The company states that apart from the general difficulties following upon the war, unforeseen and adverse events, both of an economic and social character, have occurred in the Barcelona region, which have hindered the development of business, brought about financial stringency, and caused considerable depression in the textile industry, which is such an important factor in the business life of Barcelona. Spanish exchange itself, which until recently, had been advantageous, has seriously reacted. In May, 1920, it stood at 22.99 pesetas to the £, whereas in the present month it has been as high as 30 pesetas to the £. Having regard to these unfavourable conditions, the directors and the Bondholders' Committee consider it their duty, in fairness to the bondholders, to issue a warning note that, although the receipts of the operating companies have shown considerable increase, it is possible that the net revenue of the Barcelona company may not justify payment of the interest at the increased rate on December 1st next. The question can only be settled in August, when the results of the operating companies for the first six months of the current year are known.

Italian Companies.

Società Anglo Romana (Rome).—This company closed its working year (1920) with a loss of 6,825,889 lire, the obstacles which it had had to contend with rendering it impossible to equate prices with costs. The Labriola Wages Award alone had saddled the company with a 75 per cent. increased wages burden. The meeting decided to cover the loss by drawing upon the extraordinary reserve.

Officine Elettro-Ferroviarie (Milan).—Notwithstanding the unhappy events of 1920, when the works were seized by the workmen, and despite the growing burdens on all branches of the business, the year closed with a good financial result. The net balance amounted to 1,420,021 lire, which allowed of the payment of a dividend of 12 lire to each of the 80,000 shares of the nominal value of 100 lire.

Società Elettrica Bergamasca (Bergamo).—The report showed that the year 1920 had been a hard trial for the company, which had to face continually increasing costs, with no possibility of augmenting the returns. In October they were planning the new plant on the Parina, and they were now considering the definite scheme. The accounts disclosed an available net balance of 497,467 lire, out of which a distribution of 6 per cent. would be made.

The balance sheet of the *Società anonima Gas ed Elettricità di Erba Incina* (Milan) showed an available net sum of 56,296 lire, from which a dividend of 12.50 lire would be apportioned. Other dividends declared were: *Società Idroelettrica dell'Ossola*—8 per cent. *Società Elettrica Comense A. Volta* (Como)—8 per cent. *Società Pandana di Elettricità* (Milan)—10.50 lire per share of 150 lire.

The following companies have increased their capital: *Società anonima Officine di Energia Elettrica* (Novara), from 800,000 to 1,200,000 lire.

Società Litoranea di Elettricità di S. Dona del Piave, from 700,000 to 1,400,000 lire.

Società Elettrica Alto Cremonese (Milan), from 400,000 to 800,000 lire.

Società per Imprese Elettricità di Macerata, from 1,500,000 to 2,000,000 lire.

The Società Italiana di Elettrochimica, of Rome, which has a paid-up capital of 10,500,000 lire, announces the distribution of the dividend of 7.70 lire per share for 1919-20, which was decided on at the general meeting held last January. At the same time the share capital is being increased to 21,000,000 lire by the issue of 150,000 new shares of 70 lire each at par.

Swiss Companies.

The *Elektrizitats Gesellschaft Alioth*, of Basle, which is in close relationship with Brown, Boveri & Co., of Baden, has decided to pay a dividend at the rate of 5 per cent. out of net profits of 345,000 fr. in 1920, being the same rate as in preceding years.

The report of the "*Motor*," *A.G. fur Angewandte Elektrizitats*, of Baden, Switzerland, which is a holding company for the Brown-Boveri group, reports that the investments in 1920 suffered considerably from the situation of exchange. The net profits amounted to 810,000 fr., of which 730,000 fr. has had to be written off for exchange losses, and the balance has been carried forward. The share capital remains at 36,000,000 fr., and the loans at 45,000,000 fr. The interests held by the company in the Forces Electriques Alsacienne, Forces Electriques Lorraine, and Forces Electriques Sundgo Viennes were transferred during the year to the Societé Alsacienne et Lorraine, of Nancy, in which the company holds shares.

French Companies.

The *Société Francaise des Electrodes*, of Lyons, reports net profits of 1,145,000 fr. for 1920, as compared with 1,530,000 fr. in the preceding year. A dividend at the rate of 7 per cent. has been declared, as against 8 per cent. in 1919.

The *Compagnie Le Moteur Electrique*, of Lyons, which produces motors for 25 cycles and special apparatus for starting looms, &c., has declared a dividend at the rate of 6 per cent. per annum for the first financial year, which comprised nearly ten months.

The *Société l'Electro-Métallurgique de Dives* reports that a fair resumption of business took place at the beginning of 1919-20, but was unfortunately succeeded by depression in the latter months of the year. Nevertheless the profits were materially higher than in 1918-19. After placing 1,500,000 fr. to depreciation, the accounts show net profits and balance forward amounting to 5,620,000 fr., permitting of the payment of a dividend at the rate of 60 fr. per share and the carrying forward of 2,289,000 fr.

The *Compagnie Francaise Thomson-Houston* proposes to pay a dividend at the rate of 45 fr. per share for 1920 on the 400,000 shares of 500 fr., this contrasting with 40 fr. per share in 1919. The net profits amounted to 22,900,000 fr., as against 15,685,000 fr. in the previous year. It is stated that the value of the turnover last year was 110,555,000 fr., as contrasted with 62,517,000 fr. in 1919, and that of the orders on hand at the end of the year reached 100,033,000 fr., as against 61,985,000 fr. at the close of 1919.

Compagnie d'Electricité de Limoges.—The ordinary meeting passed the accounts for the year 1920, which showed a credit balance of 494,992 fr., exceeding by 33,397 fr. that of the foregoing year. The receipts from lighting and motive power had risen to 3,255,698 fr., against 1,928,615 fr. in 1919, or an increase of 1,327,083 fr. The increase in the receipts was due to the raising of the tariffs, and applied to power users from the second quarter of the year. Working expenses were 2,340,521 fr., or an increase of 1,118,975 fr. The meeting approved of a dividend of 8 fr. per share.

Compagnie générale de Travaux d'Eclairage et de Force.—The accounts for 1920 were approved by the ordinary meeting, showing profits of 842,826 fr., or an increase of 123,542 fr. on the preceding year's figures. The distribution of a dividend of 32.50 fr. per share was sanctioned.

Direct Spanish Telegraph Co., Ltd.—The accounts for 1920 show that including the balance brought forward, and the payment of income tax and E.P.D. for 1919, there is a balance of £46,638. After paying 10 per cent. preference dividend, 10 per cent. dividend on the ordinary shares, free of tax, putting £7,000 to investment fluctuations and £5,000 to reserve, there is a balance of £25,173 to be carried forward subject to E.P.D. and corporation profits tax. The cables have worked well during the year, and duplex working on the Bilbao cable has been installed with satisfactory results.

North Melbourne Electric Tramways Co., Ltd.—The directors state that in consequence of the strikes in Australia and the increased cost of fuel, materials, and wages, the company will not be in a position to pay the interest due on June 1st on the 5 per cent. debentures. The *Financial News* states that a meeting of the holders of these debentures was to be held on Tuesday to consider a resolution agreeing that the security of the debentures shall not become enforceable on account of the interest becoming in arrear, and that the interest due June 1st, 1921, and subsequently shall only be paid when the directors consider it advisable.

India Rubber, Gutta Percha & Telegraph Works, Co., Ltd.—On May 28th the directors advised the shareholders that, owing to the coal strike, it was found necessary to close the works at Silvertown "on the 22nd inst., and there is at present no indication when normal work can be resumed." Under the circumstances, the directors could not recommend the payment of an interim dividend on the ordinary shares. The half-yearly dividend on the preference shares will be paid on July 1st.

Mexican Electrical Companies.—Particulars have appeared in the financial Press this week of a plan for reorganisation and the settlement of arrears in the case of the Mexican Light & Power Co., the Mexican Electric Light, the Pachuca Light & Power Co., and the Mexico Tramways Co., which has been prepared by the committees of these companies, and the proposals will shortly be submitted at meetings of the bondholders. While the position in Mexico continues to be difficult, the outlook is stated to be more hopeful.

Oriental Telephone & Electric Co., Ltd.—Final dividends for 1920 3 per cent. on the preference shares, less income tax, making 6 per cent. for the year; 6 per cent. on the ordinary shares, free of income tax, making a total of 10 per cent. for the year, free of tax; a bonus of 2 per cent. on the ordinary shares, free of income tax.

Electric Construction Co., Ltd.—Final dividend at the rate of 7 per cent. on the preference; also at the rate of 9 per cent. per annum on the ordinary shares, making 7½ per cent., also a bonus of 2½ per cent. on the ordinary shares; all subject to tax.

Aster Engineering Co., Ltd.—Available balance £57,165. Depreciation is provided for, 7½ per cent., free of tax, is to be paid on the ordinary shares, and £40,573 is to be carried forward, subject to E.P.D. and corporation tax.

John I. Thornycroft & Co., Ltd.—After paying interim dividends on the cumulative preference and participating preferred ordinary shares, the directors say it is not prudent at present to pay interim dividends on the ordinary shares, owing to the universal financial stringency.

Prospectuses.—*General Electric Co., Ltd.*—The prospectus offering £3,500,000 seven per cent. mortgage debentures at 92½ was to be published yesterday, Thursday.

Metropolitan Electric Supply Co., Ltd.—It is reported that the recent issue was subscribed for more than six times over.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—The profit for the year ended December, 1920, was £10,708, against £5,452 for 1919. After providing for debenture interest and £9,500 for depreciation, £108 remains to be carried forward. £7,500 debentures were paid off, leaving £7,500 outstanding.

Metallic Seamless Tube Co., Ltd.—The net profit, including balance brought forward is £40,006, less issue of bonus shares £26,000. A dividend f 10 per cent., free of tax, on the ordinary shares is recommended.

Anderston Foundry Co., Ltd.—Final dividend of 15s. per share (making 18s. per share), less tax; £10,000 to reserve fund, carrying forward £11,164.

Stock Exchange Notice.—The Committee has ordered the following to be officially quoted:—

Eastern Telegraph Co.—£1,000,000 ordinary stock.

Rothesay Tramways Co.—After putting £1,000 to reserve, the directors recommend a dividend of 3 per cent. on the ordinary shares, carrying forward £1,609.

Shawinigan Water & Power Co.—Dividend of 1¾ per cent. on the common stock for the quarter ended June, 1920,

STOCKS AND SHARES.

Tuesday Evening.

The dragging-out of the coal crisis is the main influence in the Stock Exchange markets for the time being. It begins to get upon the nerves of investors and speculators alike. Gilt-edged stocks are not quite so firm as they were, and, in the more speculative markets, the fact of trade being in so many cases at a standstill, thus leading to the tying-up of money, prevents any enterprise or initiative being shown in Stock Exchange directions. There was a lively rush for the underwriting of the General Electric 7 per cent. debenture stock, and the original underwriting of 2½ per cent. commission became readily saleable at 1½ per cent. Indeed, there is more activity in underwriting circles than there is in most of the markets round the Stock Exchange. Cable stocks are amongst the few which show a stout resistance to a heavy tendency. Derby Week is invariably a time of quiet markets, and the present year has maintained this tradition to the full.

Owing to the way in which the value of the £ has declined in relation to that of the dollar, American bonds and stocks have advanced sharply. The Utilities are better with the rest, and any security upon which the coupons are payable in New York as well as in London can count upon a place in rising markets. Canadian General Common have risen to 127½ and the preferred to 111½. Electrical Development of Ontario bonds strengthened to 106½, and Kaministiquia shares reached 100. The bonds of the latter, together with the Rio Firsts, are better at 90½. Shawinigan capital stock is several dollars up at 122½.

Argentine stocks and shares are better, by reason of the unexpectedly good showing made by the report of the Anglo-Argentine Tramways Company. The first preference hardened to 2 11/16, the seconds to 3½, and the 5 per cent. debenture stock is better again at 64½. The gross receipts for last year advanced by well over a million pounds sterling, or nearly twice as much as the expenses. The arrears and current dividends on the 5½ per cent. first preference shares were paid during the year 1920, and the directors have decided to pay one year's arrears on the second preference shares, which will bring the payment of arrears up to December 31st, 1916. The manager takes a fairly cautious view with regard to the outlook for the current year, stating his opinion that an increase of traffic cannot be estimated beyond 5 per cent. upon the year 1920. At the present rate of progress, however, it should not be long before the four years' arrears of dividend on the second preference are wiped out, which would bring the chances of a dividend on the ordinary shares into prospect. These figures emphasise the security for the 5 per cent. debenture stock, and the latter still pays 7¼ per cent. on the money.

The various London traction issues have turned back after their somewhat rapid upward progress. Underground Electric Income Bonds gave way 2 points to 76½, and the £10 shares, which had been as high as 2 11/16, reacted to 2¼, sympathetically reducing Bus "A" shares to 7s. Optimism ran unduly fast in considering prospects of a dividend on the £10 shares, and appreciation of this point no doubt brought in sellers, influenced by the dullish tone which prevailed throughout the markets in the early part of the week. The Government's intervention in the coal crisis is not taken very seriously, but neither masters nor men appear to be at all anxious to get their dispute settled. Districts and Metropolitans have held their prices; London General Omnibus Income debenture stock has risen to 66½. London and Suburban Traction preference gave way to 7s., after being 8s. 6d., and London United Tramways preference at 4s. are also a few pence down from their recent best.

Substantial improvements have occurred in Anglo-American stocks, Globe ordinary and Great Northern Telegraphs. The rise of 50s. in the last-named is due, of course, to the increase in the dividend, to which reference was made here last week. It is said that some of the buying has come from Denmark, which is not improbable, seeing that the company has a considerable following in Copenhagen, where its headquarters are situated. The Eastern group continues in favour, owing to the financial strength of the various companies, added to the fact that the dividends on the ordinary stocks are paid free of tax. In Marconis there is very little going on. All the recent effervescence has escaped from the market, which is now as uninteresting as champagne in a decanter. Indo-Europeans have gained £2 in sympathy with the jump in Great Northerns.

Important and unexpectedly pleasant circulars are issued this week by the Mexican Light and Power, the Mexican Electric Light, the Pachuca Light and Power, and the Mexico Tramways companies, with reference to a plan of reorganisation between the respective companies and the bondholders. These proposals are to be submitted for the approval of bondholders at meetings to be held later. Arrears of interest on the first three named companies' bonds, it is suggested, shall be satisfied by payments of 75 per cent. in cash on the ratification of the agreement, while the remainder will be disbursed by instalments before July, 1923. The Tramways Company

arrears are to be dealt with later on, and, meanwhile, regular interest payments will be resumed on its 5 per cent. bonds next September. This is better than even optimism had looked for, but, so far, it has had little quotable effect upon the prices of the bonds, for the simple reason that nobody wants to sell, and prices are therefore practically nominal. Mexican Electric Light Fives have risen to 65½. Mexican Light and Power Fives to 70½, and Pachuca Fives to 64½. After having waited so long for their interest, bondholders will feel exceedingly gratified at the proposed arrangement, for the most hopeful views that have prevailed hitherto were that half the interest would be met in cash and the other half in scrip.

Electric Constructions are sixpence better at 16s. 9d., but Babcock & Wilcox at 2½, ex dividend, are ½ lower on the week. India-Rubber shares have eased off to 16s. 3d., showing a fall of 1s. 3d. Telegraph Constructions are hardening, together with the prices of cable stocks, and are now 20½. Siemens are 23s. 3d. ex 1s. net dividend, and the new shares are about 6d. less, continuing the cheaper of the two. County of London Electric ordinary stiffened to 8, and Metropolitan ordinary to 3½. The Metropolitan Company's debenture stock was largely over-subscribed. Applicants for £10,000 received allotments for £1,000, and those who applied for anything under £400 were given £50. Evidently, however, a certain amount of stagging occurred, for the price opened at 2½ premium, and lost the fraction later on. Rubber shares are better, on the fact that deliveries of rubber exceeded landings last week, for the first time in six months. Armament and similar shares are still inclined to be dull, in consequence of the deadlock in the coal trade.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price May 31, 1921.	Rise or fall.	Yield. p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	8½	—	10 6 6
do. do. do. 4½ Pref.	4½	4½	8	—	7 10 6
Chelsea	4	6	8½	—	9 4 8
City of London	13	14	17½	—	11 16 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	8	8	8	+ ½	10 0 0
do. do. 6 per cent. Pref.	6	6	8½	—	7 7 8
Kensington Ordinary	7	9	44	—	10 18 2
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	22	—	10 18 2
Metropolitan	6	7	8½	+ ½	10 0 0
do. 4½ per cent. Pref.	4½	4½	2½	—	7 13 2
St. James' and Pall Mall	12	12	6	—	10 0 0
South London	6	7	2½	—	9 2 10
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	5½	—	9 15 2
Telegraphs and Telephones.	1918	1919			
Anglo-Am. Tel. Pref.	6	6	81½	+2	7 7 8
do. Def.	33/6	1½	17½	+1½	8 11 6
Chile Telephone	6	6	5½	—	5 6 8
Cuba Sub. Ord.	7	7	7½	—	9 6 8
Eastern Extension	10	10	16½	—	6 2 2
Eastern Tel. Ord.	8	10	166½	+3	6 0 4
Globe Tel. and T. Ord.	8	10	16½	+ ½	6 0 4
do. do. Pref.	6	6	9½	—	6 9 9
Great Northern Tel.	22	22	20½	+2½	9 1 2
Indo-European	13	10	84	+2	7 7 1
Marconi	25	25	2½	+ ½	—
Oriental Telephone Ord.	10	12	2½	—	*5 13 0
United R. Plate Tel.	8	8	6¾	—	6 10 6
West India and Panama	1/8	Nil	⅛	—	Nil.
Western Telegraph	8	10	16½	+ ½	*5 18 5
Home Rails.	1919	1920			
Central London Ord. Assented	4	4	48½	—	8 15 10
Metropolitan	1½	1½	26½	—	5 17 8
do. District	Nil	Nil	19	—	Nil
Underground Electric Ordinary	Nil	Nil	2½	— ½	Nil
do. do. "A"	Nil	Nil	7/-	- 1/-	Nil
do. do. Income	4	2	76½	—2	2 12 4
Foreign Trams, &c.	1918	1919			
Anglo-Arg. Trams, First Pref.	Nil	8½	2½	+ ⅛	8 3 6
do. do. 2nd Pref.	Nil	Nil	8½	+ ½	8 16 0
do. do. 5 % Deb.	5	5	64½	+1	7 15 0
Brazil Tractions	Nil	Nil	38	—	Nil
British Columbia Elec. Rly. Pfce.	5	5	66	+1	8 18 6
do. do. Preferred	2½	5	83½	—	*8 15 0
do. do. Deferred	Nil	8	81½	—	*11 17 6
do. do. Deb.	4½	4½	69½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	43	—	Nil
do. 6 per cent. Bonds	Nil	Nil	23½	—	Nil
Mexican Light Common	Nil	Nil	11½	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	Nil	70½	—1½	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	2½xd	— ½	7 2 3
British Aluminium Ord.	10	10	16/3	—	12 6 2
British Insulated Ord.	12½	15	1⅝	—	9 13 0
Callenders	25	15	1½	—	10 0 0
" 6½ Pref.	6½	6½	17/6	—	7 8 7
Crompton Ord.	10	10	16/3	—	12 6 2
Edison-Swan	10	10	11/3	—	—
do. do. 5 per cent. Deb.	5	5	70	—	7 2 10
Electric Construction	10	10	16/9	+6d.	11 18 10
English Electric	—	8	12/-	—	13 6 8
Do. Pref.	—	6	14/6	—	8 5 6
Gen. Elec. Pref.	6½	6½	17/6	—	7 8 7
do. Ord.	10	10	22/-	—	*9 1 10
Henley	25	15	1⅞	—	10 8 8
do. 4½ Pref.	4½	4½	8½	—	6 18 6
India-Rubber	10	10	⅛	— ⅛	—
Met.-Vickers Pref.	—	8	1½	—	8 16 10
Siemens Ord.	10	10	23/3xd	—	*8 12 0
Telegraph Con.	20	20	20½	+ ½	*5 17 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, May 31st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	10d.	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£65	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£34	..
a Copper Sulphate	"	£58	..
a Potash, Chlorate	per lb.	7d.	1d. inc.
a " Perchlorate	"	8d.	..
a Shellac	per cwt.	£90 10s.	20/- inc.
a Sulphur, Sublimed Flowers	"	£18	£1 dec.
a " Lump	"	£16	£3 dec.
a Soda, Chlorate	per lb.	5d.	..
a " Crystals	per ton	£7	..
a Sodium Bichromate, casks	per lb.	9½d.	1½d. inc.
METALS, &c.			
p Babbitt's Metal Ingots	per ton	£95 to £300	..
c Brass (rolled metal 2' to 12' basis)	per lb.	11½d.	½d. inc.
c " Tubes (solid drawn)	"	1/1½ to 1/2	..
c " Wire, basis	"	11½d.	½d. inc.
c Copper Tubes (solid drawn)	"	1/9½	..
c " Bars (best selected)	per ton	£116	£2 inc.
c " Sheet	"	£116	£2 inc.
c " Rod	"	£116	£2 inc.
d " (Electrolytic) Bars	"	£77	£4 inc.
d " " Sheets	"	£145	..
d " " Wire Rods	"	£93	£4 inc.
d " " H.C. Wire	per lb.	11½	1/32d. inc.
f Ebonite Rod	"	8/6	..
f " Sheet	"	8/-	..
n German Silver Wire	"	2/9	..
h Gutta-percha, fine	"	14/- to 16/-	..
h India-rubber, Para fine	"	10½d.	½d. inc.
l Iron Pig (Cleveland Warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	£23 15s.	25/- dec.
g Mercury	per bot.	£11 5 to £11 10	..
e Mica (in original cases) small	per lb.	4d. to 4/-	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25/- & up	..
p Phosphor Bronze, plain castings	"	1/4 to 1/9	..
p " " rolled bars and rods	"	2/1 to 2/6	..
p " " rolled strip & sheet	"	2/3 to 2/7	..
d Silicium Bronze Wire	per lb.	1/4	½d. inc.
r Steel, Magnet, in bars	"	1/8	..
n Tin, Block (English)	per ton	£174	£4 dec.
n " Wire, Nos. 1 to 16	per lb.	4/-	..
p White Anti-friction Metals	per ton	£78 to £300	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
p ——
r W. F. Dennis & Co.

Belgian Pension Funds.—The directors of the Belgian investment company having the title of the Société Générale Belge d'Entreprises Electriques, in the course of their report for the past year, mention that independently of a share in the profits which they have granted to the *personnel*, they have provided for an allocation of 50,000 fr. in view of the organisation of a provident fund in favour of the staff. For this purpose they have come to terms with the Caisse Nationale de Retraite et d'Assurance to ensure to the company's *personnel* at the age of 65 years a retiring pension which can amount to three-fourths of the final salary. In the event of death a life annuity of 40 per cent. of this salary will be paid to the widow or to orphans who have not reached their majority. The Société Financière des Transports et d'Entreprises Industrielles, which is a second Belgium investment company, has followed on similar lines. The directors state that they have decided to allot to the *personnel* every year an amount corresponding to the dividend on 3,000 shares, two-thirds of the amount representing a participation in the profits and the remainder serving for feeding a pension fund. It will be possible for the *personnel* to increase their pension funds by voluntary payments, to which the company will every time add a premium of 10 per cent. A first endowment of 50,000 fr. corresponding to the dividend for 1919 has been placed to the pension fund during the past year. This sum has been put to the debit of the profit and loss account, as well as the allocations for 1920 of 120,000 fr., as the share in the profits, and of 60,000 fr. for the pension fund. In making these arrangements, which have been under investigation for a long time past, the directors remark that they have desired more directly to associate the staff with the financial results obtained by the company on the one hand, and on the other to constitute in their favour a pension fund which will remove the anxieties which they could experience when thinking of the time when age would prevent them from working, or of the eventuality of a premature end, leaving their families in pecuniary difficulties.

ELECTRICITY SUPPLY TARIFFS.

(*Concluded from page 697.*)

The first paper that was discussed at the Institution of Electrical Engineers on April 26th was abstracted in our last issue. Mr. Beauchamp's paper is abstracted below:—

Multi-part Tariffs for Domestic Electricity Supply.

By J. W. BEAUCHAMP (*Abstract*).

The object of this brief paper is to draw attention to the urgent necessity of accepting the principle of multi-part charging for electricity supply; to show that flat rates, and minimum charges based upon them, have outlived their usefulness, and that the progress of electricity supply has left behind the conditions which gave rise to certain features of early electricity legislation, and so rendered them out-of-date and obstructive to progress.

It is generally accepted that the multi-part tariff in some form is the most promising and equitable, and its progress has been delayed perhaps by too strong a desire to fix upon a correct or uniform tariff, rather than acceptance of the underlying principle and determination to put it into use and allow experience to dictate the details most suitable for each district. Furthermore, there has perhaps been too much tendency to consider proposed tariffs in relation to individual consumers, rather than in relation to groups of them.

The multi-part tariff and its calculation divides itself into two sections, one concerning the running rate or rates per unit for the energy supplied, which is not difficult to determine, the other concerning the fixed charges. The latter present greater difficulties, because they must bear some relation to standing costs incurred now, and to be incurred later as a result of the new tariff and the extra business it will bring; in addition, they must bear a relation to something tangible and easily understood by the consumer in order that he may feel their equity.

Development will entail extension and must be able to pay for it, and it is for this reason that new tariffs should be designed to take care of the standing costs so that the unit charge may be kept low, resulting in a distinctly dropping average cost as the load factor increases. Many tariffs have failed in their object because, whilst sound perhaps in principle, they did not in practice offer progressive encouragement to the steady introduction of more and more consuming devices. The home supply tariff may start with quite a high rate for normal lighting, and may secure a fair price for small additional use in fans, kettles, &c., but should continue to decrease through the consumption in cookers, fires, &c., ending in a minimum value which would apply to storage heaters or other 100 per cent. load-factor uses.

Most of the two-part tariffs in use constitute a minimum charge, the annual or quarterly amount being payable irrespective of the number of units used. In some systems the fixed charge covers a certain number of units, and is so far an agreed minimum payment; in others the fixed charge covers no supply but only readiness to supply, or service.

This form is the best and should be developed, because the charge is not made for any particular supply, but rather for maintaining the connection, so disputes cannot arise as use is restricted. On the other hand, the knowledge that every unit is supplied at one or more low rates and that the meter records only these cheap units encourages use and reduces anxiety about waste. This is as it should be, because the increasing use of the supply and particularly the employment of apparatus always in circuit soon causes the average cost of the unit to approach the running rate.

The best method of bringing home the soundness and advantages of the multi-part tariff lies in putting it forward as an alternative to a very high flat rate, and it will be necessary either: To secure the right to associate such tariffs with much higher statutory maximum rates than now possible; or to introduce the new systems by means of very active propaganda, and support them by hiring out many of the appliances which the consumers will need if they are to take the fullest advantage of such tariffs.

A request was made that the Electricity Commissioners should have the power to make such tariffs compulsory in any district or part of a district where the suppliers desired it, and could show good reason for its adoption; or failing this that where the suppliers were willing to charge on such a system their action should be supported by permission to impose an alternative flat rate much higher than would otherwise have been allowed.

Suggested Skeleton Domestic Tariff.

Fixed Charge per Annum.—On capacity of apparatus in use or usable (divided quarterly into equal p[illegible] otherwise).

1. *Lighting.*—Up to and including 250 watts, £*x* per annum. Above 250 watts, per complete 50 watts, £*x*/10 per annum.

(Intermittent lighting can be excluded, or a percentage only of installed lighting taken into account.)

2. *Heating and Power.*—Small appliances (say, up to 600 watts each, with an aggregate limit of 2,000 watts) having a very high "group" diversity in time and extent of use. No fixed charge.

3. *Heating and Power.*—Appliances as (2), above 600 watts each and 2,000 watts aggregate. Ranges, fires, water heaters, &c. At the rate of 250 watts for £*x*/20 per annum in steps of 250 watts.

Running Charge per Unit.—A flat rate for all purposes.

Under such a system as outlined above, the average cost of energy would decrease upon the addition of extra appliances.

The introduction of electricity supply into the new housing colonies affords a good opportunity for experiment with multi-part tariffs on account of the standardised character of the houses and the probable similarity of habits amongst those who will occupy them. The best method is to impose a fixed charge and provide for all supply to be recorded by one meter for each consumer and charged at a simple flat rate for all purposes.

The lighting business in connection with such property should be regarded rather as a means than an end, and the tariff and metering systems should permit of that progressive electrification of the houses from which so substantial a return is promised. For the same reasons, special treatment of such installations with regard to pressure of supply is to be deprecated, as the smallest house occupied by a family would consume not less than 1,000 kWh per annum, and should take a great deal more.

Every encouragement should be given to devices of the heat-storage class. There will no doubt be a field for small geysers, and the difficulties arising from this class of apparatus are only relative; where distribution mains are heavy they may not be so unwelcome, and the use of very large numbers would produce a valuable load owing to diversity in use, but the heavy cost of internal wiring must also be against them from the consumer's point of view.

To allow of developing the domestic load, mains must be provided on a generous scale and can only become remunerative when the load is obtained. Under present circumstances it is not easy to obtain money for such works which, although practically imperishable, may yet be a source of loss for a considerable time. As against this it must be remembered that the cost of a mains network does not rise at the same rate as the energy-delivering capacity provided; particularly is this the case where road work is expensive.

One undertaking in the Midlands with a very high output per head of population, low average price, and good financial results, reports:—

"The use of multi-part tariffs has greatly increased the demand for supply and for apparatus; very few complaints have been received, and although the accounts of this group of consumers have increased considerably they are the most satisfied of all the consumers. . . .

"The multi-part tariff has helped the business in small appliances by cutting out the cost of special wiring and plugs. At the present high lighting rates people hesitate to use irons, &c., on lamp circuits, and object to the cost of separate circuits for small apparatus. The multi-part tariff has overcome this difficulty. Tariffs of this class have come to stay."

Discussion.

The President said that Mr. Blaikie's paper covered very wide ground from Hopkinson's original paper to the modern idea. Upon first reading through the paper, he (the president) was inclined to disagree with many points as impossible of attainment; later, however, he came to believe that Mr. Blaikie's broad conclusions seemed to provide a solution of the tariff problem. Mr. Beauchamp's paper gave some data of great value in view of the large number of houses now being erected. There *was* a proper system of charging, and it remained for engineers to find that way and bring it forward, even if it meant special legislation.

Mr. Arthur Wright said that as a supplement to Messrs. Blaikie's and Beauchamp's very opportune and suggestive papers, he would like to mention some conclusions he had arrived at during the 20 years that had elapsed since he read his paper on "The Profitable Supply of Electricity." The following modifications and additions might be made to the original Hopkinson proposals: (*a*) As it was impossible to obtain by measurement the true demand on the supply authority of the numerous and ever-increasing small electric appliances and occasionally-used lamps in dwelling houses, it was necessary to adopt some demand charge based on the number of installed lamps in the living rooms or these rooms' cubic capacity, thus leaving out all the rest of the consuming devices whose combined load factor and time-incidence of their use were, in all probability, such as to entitle their owners to the lower rates given to small power users. (*b*) All consumers were entitled to a sliding scale of rebates based on their total annual consumption. (*c*) An adequate monthly service charge should be imposed instead of meter rentals or minimum number of units chargeable. (*d*) A power factor clause should be insisted upon for all alternating industrial supply based on the monthly maximum kVA demanded, and not on the average power factor during the month. At present there appeared to be two distinct methods of designing tariffs. First, those based on what the market could bear, and secondly, those based on a reasonable profit on the approximate cost of individual supply. While the first had the advantage of following ordinary commercial practice, and were easy of application, he thought the second had a much greater chance of extending the profitable use of electricity and

of meeting with the support of the governing commissions, because of their greater equity. Industries dealing with more than one town, to be really efficient, must be carried on by private enterprise and rewarded by a substantial return on the actual investment. He was convinced that salesmanship and exhibits had much more effect in getting business than had simplicity or lowness of tariffs. The complexity of the rates in America had not prevented electrical development. The heavy cost of wiring and appliances to-day required skilled salesmen to obtain orders for a supply, and the public who could never hope to understand the necessity of differential rates had now the Electricity Commissioners to look to for fair treatment. Unless he had misunderstood Mr. Blaikie, the latter seemed to think that the present day fixed costs bore a smaller proportion to the total costs than they did in pre-war days. This was such a vital point in Hopkinson's analysis that he thought it well to point out that in dealing with future costs it was probable that the high rates of standing and running charges in all the usual 20 per cent. load factor business would be likely to continue, because of the increase in the cost of money, equipment, taxation, skilled labour, and the now ascertained large amount of coal used for standing by ready to serve. Running coal and rough labour were more likely to become cheaper in the near future than the above standing cost items. The increased use of the present investment was so vital and helped so much to lower total charges that Mr. Wright thought some sort of rebate on an individual's increased yearly consumption was a tariff clause worth considering, and that a stepped discount on quantity was the proper method of lowering the present high charges when times justified some reduction. The real test of a tariff's soundness was the resulting increase of the profitable part of the business. Office and shop window lighting would always be unprofitable, even at present high rates, and should be looked upon as a price for the franchise or as a necessary tax only to be taken on for reasons of policy. With regard to Mr. Beauchamp's strong advocacy of an adequate service charge, the speaker thought it should be known that at least ten Public Service Commissions in the United States had admitted the equity and commercial necessity for such a charge. While on the subject of changes that required the assent of the authorities, he considered it would be advisable to obtain some relaxation of the pressure regulations, which were evolved during the carbon lamp and cheap equipment times, and which entailed needlessly expensive mains and regulators, owing to the fact that tungsten lamps were almost self-regulating.

Mr. H. W. Couzens considered that any tariff which appeared within reason would satisfy considerate consumers. Not only were special rates required for cooking apparatus, there was a necessity for consultation between manufacturers, traders, and station engineers so that the appliances should be improved to a great extent. Referring to a fixed charge, he gave one or two instances where this appeared exorbitant, although it was really a just charge. It was difficult to explain the fixed charge to the consumer. In connection with the development of the cooking load, Mr. Couzens said that the Brompton & Kensington Co. now had about 500 cookers connected to its mains, representing a load of about 2,000 kW. The actual increase in the company's peak load, due to these cookers, amounted to about 250 kW. The speaker said that often charges were based on the kilowatt-capacity of the apparatus installed, and cited a case where the annual charge was £30 per kW with a flat rate of 2d. per unit. He thought the mains problem was not so difficult as it appeared, especially where alternating current was used.

Mr. P. D. Tuckett said that Mr. Beauchamp's paper indicated the most hopeful way out of the difficulties of the smaller undertakings. At present thousands of consumers were being supplied at a loss, and thousands at a price higher than they wished to charge them. With a contract tariff on a sound basis, the supply undertaking would make an adequate fixed charge and a small unit charge. To aim at a scientifically correct tariff was hopeless. The best course was to induce the Government to allow a high maximum rate, with an alternative multipart tariff. The expenditure of new capital involved a much higher charge per kilowatt than was formerly the case, and in increasing the fixed charge this should be kept in mind. If the multipart tariff was to be successful, the accessory uses of electricity must be developed. Were they satisfied that the heating load was really better than the lighting load? It came on the peak and in the winter season.

Mr. F. W. Purse was inclined to differ from Mr. Beauchamp. Consumers were apt to compare their bills and to make trouble. A simple tariff was essential. Manufacturers ought to make heating and cooking apparatus of greater reliability. Even with a multipart tariff and a single meter, a single circuit could not be used for all purposes; the lighting circuit should be separate from the heating and power circuit throughout. Further, owing to the wide range of load, a single meter was not satisfactory, as light loads would not be accurately recorded. The cost of mains to provide for increased consumption was a serious obstacle to development. Lighting was cheap at 8d. or even 1s. per kW-h, and the peak load must bear a higher charge. Power was far preferable to heating as a load.

Mr. E. W. Cowan dealt with fundamental principles, distinguishing between cost of service on the one hand and value of service on the other. For many years people had dealt only with the former aspect of the question, ignoring the latter, but that attitude of mind was not now so prevalent. The electrical industry was endeavouring to adapt prices to market conditions. Dr. Hopkinson never confined his attention to the cost of service, which in any individual case could only be approximately estimated, and should only be used as a guiding influence, not as the determining factor. Both aspects should be taken into account. Mr. Blaikie's proposal was open to the charge of profiteering; no group or class should be charged at a low rate at the expense of another, nor should consumers be taxed for the benefit of non-consumers. All businesses must necessarily include items which appeared to show a loss, and price-making could not be treated as an exact science.

Mr. Minton said Mr. Blaikie's 6-day group could be called the one-meter group, and the 7-day group the hundred-meter group. With regard to bulk supply, a meter accuracy clause should appear in the agreement—it was a very important matter when dealing with energy in large blocks.

At the resumed discussion on May 5th, Mr. J. R. Blaikie said that in accordance with the desire expressed by Mr. Wright, he would display two charts. One showed the relationship existing between the number of units generated and the number of tons of coal consumed; this showed a serious increase for the years 1917 and 1918, and this was, in a great measure, attributable to the seven-day group. The other showed the reconstitution of coal bills, and proved that the figures obtained came very near to the actual figures.

Mr. Beauchamp, showing some diagrams prepared by Lieut.-Col. W. A. Vignoles, said that the experience gained at Grimsby proved the unit of electricity to be an unsatisfactory basis of charging for lighting. As stated previously, the first chart showed that until a consumer took 100 units he was unremunerative, and 9 per cent. of the Grimsby consumers did not use 100 units. The second diagram showed the cost per unit in relation to the maximum demand. This brought out the impossibility of fixing a flat rate fair to all classes of consumers.

Mr. A. N. Rye said he was pleased with Mr. Beauchamp's paper. His company had adopted a two-part tariff, and it soon became so popular that it represented 50 per cent. of their revenue. The two-part tariff, however, was now dying out, probably because of the insufficiency of maximum charges. The company had had to force up minimum charges by 100 per cent., which penalised the smaller consumers. The improved efficiency of lighting had caused a large falling off in load. Mr. Rye mentioned that 12 cases, which in 1905 required 10,000 units, had only taken 5,000 units in 1920. In spite of the doubled prices the revenue was, therefore, practically the same.

Mr. W. A. Gillott said that only by close attention to characteristics of the load on particular systems could a satisfactory tariff be arranged. A tariff, to succeed, must be competitive and easy to understand. In Newcastle many systems of charging had been devised, and this enabled the suppliers to differentiate to a large extent between different classes of consumers. It was best to make a fixed charge having some relation to the actual consumption of the consumer; any fixed charge should be such that a consumer could understand its connection with his own installation. This fixed charge would be dependent on local conditions. Mr. Beauchamp had suggested a separate fixed charge for lighting and for each appliance. The speaker did not agree with this, as the general diversity factor permitted an average fixed charge to be made reasonably. Mr. Gillott said that it had been observed in Newcastle, where there was a very heavy cooking load, that this just filled up the valleys in the load curve which occurred when the works shut down during the dinner hour. In conclusion, he would state that there was no doubt that the domestic load was *the* load of the future.

Mr. W. R. Cooper considered that the provision of electricity for water heating should be made as a matter of expediency, not of revenue, as this would be a great advertisement for electricity. This could be done on a two-part tariff if the running charge was low enough. He did not feel convinced by Mr. Beauchamp's paper. Tariffs should be sound and not merely convenient. The principles propounded by Hopkinson were still sound, although necessary adjustments due to progress would have to be made from time to time. Mr. Blaikie would favour the six-day consumer, but surely he used just as much station plant, although, no doubt, there would be a saving on his mains. No provision was made for a six-day consumer running two shifts. The seven-day loads were generally very desirable ones, including, as they did, tramways, public lighting, cooking, &c. The speaker criticised Mr. Blaikie's use of simultaneous equations in the allocation of coal and fixed charges. He pointed out that to give satisfactory results the x and y would have to remain the same from year to year. Mr. Cooper showed slides giving the Klingenberg daily characteristics of a power station with one and more sets running. In the curves thousands of pounds of coal were plotted against hundreds of kW-hours produced.

Mr. J. R. Dick said that the fixing of tariffs was a question of costs, and the problem of charging for electricity had its analogies in many other industries. It used to be considered adequate to call fixed charges the same as capital charges. But fixed charges contained so many different items. Under the old systems of works costing it was considered sufficient to take overhead charges and add them as a percentage to

the prime cost. It had been found necessary, however, to split these up according to the various jobs. One job might require the running of a heavy machine for a short time and another a lighter machine for a longer time. Then there were indirect labour, rent, rates, and taxes to be taken into account. He considered Mr. Blaikie's six and seven-day principle quite sound, although the accuracy of the simultaneous-equation method might be doubted. He praised the apportionment of charges adopted. The speaker pointed out that the cost of labour, coal, &c., was a function of the currency, and when this became normal prices would reach their proper level. Mr. Beauchamp was conscious of the danger of a suddenly increased lighting load rendering the fixed charges inadequate. The existing cables would no doubt be able to carry all that was required of them for the present, but in the event of an increase due to a popular tariff many additions would have to be made to the networks. He suggested that the constant current-density principle should be applied in certain cases instead of the constant-pressure system. The obtuseness of consumers in failing to understand the method of charging was often quite wilful.

Mr. W. L. Madgen, speaking from the commercial point of view, said that in some districts the number of possible consumers had been connected, and therefore the number of outside people who could be induced to take electricity was small. The introduction of a satisfactory differential tariff would no doubt cause the existing consumers to increase their load. The Electricity Commissioners had been asked to insert a clause permitting two-part charges in the No. 2 Electricity (Supply) Bill which was now pending, and which he (Mr. Madgen) hoped would continue to "pend." There was a tendency on the part of mains engineers to connect up any sort of consumer—large or small—indiscriminately, and many of these were unremunerative. Lighting consumption had been severely reduced by the daylight saving scheme, early closing, and the growing efficiency of the electric lamp. He had been assured that German and Austrian scientists had been working very hard during the war, and that a ¼-watt lamp was on the horizon. Before that happened they must have a two-part tariff system.

Mr. J. C. Elvy remarked upon the fact that meter manufacturers had been silent in the discussion. The condition of meters was a vital factor in the collection of revenue. A meter that was fast or slow would result in a loss to either the consumer or the supply undertaking. He spoke of an undertaking where half a dozen or more different rates were in force, each requiring a separate meter, and he wondered if the cost of maintenance was worth it. To permit lower charges the cost of installation would have to be lowered.

Mr. H. M. Sayers objected to classing traction supply with that of seven-day consumers. He noticed that Mr. Blaikie had given a curiously high coal consumption for the no-load period; his own investigations had produced a result which was materially different from that obtained by the author. The method of using simultaneous equations had not been fully explained in the paper, and, therefore, it could not be properly criticised. He asked Mr. Beauchamp if it was any good discussing the value of various tariffs when a tariff could only be enforced by means of a monopoly, which was not a desirable procedure. It was not possible to obtain even a regulated monopoly neither was it possible to evolve any suitable tariff if it was not based on costs. The domestic tariff problem was a difficult one, but there were other difficulties such as those of the costs of apparatus and installation. They should follow the example set by the gas companies and make the charges for rental of apparatus take the place of the fixed charges.

Mr. W. B. Woodhouse explained that they sold only one article, but they were obliged to stock electricity for all purposes and, therefore, they should be allowed to charge for doing so. Alternatively they should be given some sort of relief; either they should be able to refuse to supply unprofitable customers, or charge them. In some areas served by small stations even a charge of 2s. per unit would not pay, a fact which had to be faced. They must divide their customers into classes, and be prepared to vary the profit they were to realise from each class. Unless they could find the capital required for development the expansion of the domestic supply, which they were all discussing, would not take place.

Mr. W. R. L. Phillips thought that the principle advocated in Mr. Blaikie's paper was sound; it was not a matter of dividing into six or seven-day consumers, but of some form of grouping, and that should be encouraged. It was evident that current tariffs were quite out of date, and the sooner that subject was settled the better.

Mr. Ritter was also of the opinion that all evidence pointed to the present tariffs being quite unsuitable. He thought that there must be something wrong with the figures in Mr. Blaikie's revenue sheet for 1915-16.

The President (Mr. Ll. B. Atkinson) pointed out that the discussion had shown a more or less general desire for some form of two-part tariff; the question, however, was: How were they to enforce it? When the matter was brought before the Electricity Commissioners they were received with courtesy and fair words, but unfortunately nothing further was done. He, nevertheless, was quite sure that the Commissioners realised the position they were in just as well as they did, but they were bound by circumstances, political ones, over which they had no control.

Mr. J. R. Blaikie, in briefly replying to the discussion, referred to the criticism of his use of simultaneous equations, and reminded the meeting that he had dealt with that matter very cautiously in his paper.

Mr. J. W. Beauchamp, also in reply, said there was no reason why a number of supply undertakings should not put multi-part tariffs into use immediately. Several such tariffs already existed, but had been allowed to languish as a result of the price increases introduced. It was not reasonable to suggest that they should sell energy at a price less than the highest they could get from the buyer. The real problem, however, was the distribution system. If the development of the domestic load came about to the extent that they expected they would have to deal with some gigantic distribution networks.

JOINT ELECTRICITY AUTHORITIES.

The West Riding Inquiry.

(*Continued from page* 699.)

Continuing the examination of Mr. Arthur Collins, city treasurer of Birmingham, as a financial expert, on behalf of the Leeds scheme, Sir Harry Haward suggested that in order to obtain a proper view of the position of the Joint Authority, with which the Commission was primarily concerned rather than with the existing stations, the financial tables ought to be split up, differentiating the figures as to the new Joint Authority from the general figures. The tables were on a paper scheme and not in correspondence with actual facts which would result from the Leeds scheme, which showed that in 1925 the working costs of the new capital station would be 0.625d., and the capital charge would be 0.525d. The cost of supplying energy from the new station of the Joint Authority would be 1.19d., and Leeds Corporation supplying from its own undertaking, stated in column D of the table, would have working expenses of 0.768d.—Witness suggested that the average figure must be taken. Sir Harry said he was taking the existing station. Taking it at 0.727d., that included, he presumed, the new station at Leeds, and the capital charges would be 0.692d., giving a total of 1.419d. for Leeds. Was not that the proper comparison?—Witness agreed, taking that test; taking an average price from the new station, plus the local charges on existing stations, he thought it would be dangerous to take that figure, because it assumed that the price at which Leeds would get energy from the Joint Authority would be an average price, whereas it would depend on the kW taken, and that might not be an average price. On the whole, he had concluded it would be safer to take the average throughout. Until they knew the demand it was difficult to take the table figures as an average price. He agreed with Sir Harry that the question of price to be charged had not actually been raised, but it was a material point. Leeds, he continued, took the view, in the matter of capital outlay, that this was exactly the type of case in which the Commissioners might be asked to exercise their power to recommend the Ministry to finance this scheme in its early stages. Whereas promoters of electricity schemes generally started out with the idea that Joint Authorities should buy out the undertakings in their areas, the conclusion had now been come to generally that there were certain limits beyond which it was dangerous to go. Very old stations, likely soon to be discarded, should not be saddled on the new authorities. Where the authority could sell energy to an old undertaking at such a price that the old undertaking could not compete with it, the old local undertaking should remain at the cost of the local area. The temptation would be open to owners of the old plant to change from generators to distributors if they had bulk supply at an equal charge. It was difficult to draw a line as to which stations should be taken over, particularly where stations had to be kept as a stand-by for the common good. He expressed no technical opinion, but the Joint Authority would be well advised financially to keep clear of purchasing an undertaking which was working efficiently under existing powers, at any rate until it was thoroughly well established. The Yorkshire Power Co. covered an area beyond the Aire and Calder district, and if the company were to be bought out in respect of the part within the district there would be a substantial claim for severance which would involve heavy capital on which there would be no direct benefit. In the course of less than 42 years it was possible, as was being shown by London companies, for the company so to readjust its conditions as materially to reduce the amount of severance claim. The delay would make it possible for the company to work out the money involved in the undertaking. He did not think the Conference scheme, depending so greatly on acquisition of the company, could be carried out except by Act of Parliament.

The Chairman: Or by agreement.—Quite; but I should not expect the company would be willing sellers except at a price which it would not pay the Joint Authority to give.

Witness then went on to explain the capital involved in the Leeds scheme, and remarked that one had to consider how that capital was to be provided having regard to the many local requirements of the various local authorities claiming the use of their available capital. Even if the Bill passed, he was afraid there would be difficulty in measuring the credit

of the prospective Joint Authority. It was more difficult to raise capital in the money market for a body comprising various authorities than for a body comprising a primary authority. The prospectus could do little more than intimate a rosy future and rather intangible assets. Probably it would get the money, but it would be at a price which would defeat the object of the cheapest possible electrical supply. His own experience indicated that the money market would favour a combination of local authorities and companies rather than of local authorities alone, the view being that companies were accustomed to the market, and that would bring the prospectus to the notice of a wider sphere of investors. Joint Authorities would be well advised to keep out of the money market at present. The second course would be for local authorities to secure the money amongst themselves, but when faced with shortage for their own various local purposes there would not be marked enthusiasm to provide their local quotas, and the burden in the main would probably fall on the five bigger towns. They might be sufficiently public-spirited to find the money, but when they had got their original flotation, the second and third calls might lead to unfortunate consequences in one or two bigger towns having to find the money alone at the finish. With regard to repayment of the advance suggested in clause 48 of the Leeds scheme, witness asked for the insertion of the words "within such periods as are ordinarily regarded for repayments of loans for the various purposes of an electricity undertaking." He asked the Commissioners to consider making this advance exactly in the manner of advances by the Public Works Loan Commissioners. The worst stile in the Leeds scheme was the provision of the first instalment, after which there would be tangible assets.

Leeds had taken the only logical course. The basis on which electricity could be supplied to any authority in the area depended on natural advantages at the point of production as much as on anything, and with a number of sites available the claims of the Power Co. must be considered. Local authorities were more deeply concerned in distribution than in generation, and if the Power Co. would supply in bulk and provide the capital itself, the local authorities would be well advised to take electricity from it unless they had such natural advantages themselves that they could produce more cheaply, which was not so in this case. The Leeds scheme was the best possible compromise.

Mr. MILLER, cross-examining Mr. Collins, drew witness's attention to figures showing, as against Mr. Collins's contentions as to comparative coal costs between Leeds and Bradford, that in the years 1917-18-19, the Bradford costs were less than those of Leeds. With regard to finance, witness agreed that if the local authorities could get over the difficulty of having to pledge the rates as security they might be in a better position in the money market, but the companies, in issuing a prospectus, could say: "We have a running station and its revenues," whereas the Joint Authority would have nothing but a station in embryo, unless it offered its rates as security. He was afraid some of the smaller authorities in the Conference scheme would not stand the test. He agreed that the electrical prospects of the area were excellent for a flotation—probably second only to London—but in any district where there was a vigorous gas undertaking there was a limit beyond which the price of electricity could not go, whatever the need, and it had to be remembered that the cost of building a new station now was three times the pre-war cost, and the interest on capital was twice that of pre-war times, so that the annual cost of the new station would be about six times that of pre-war.

In answer to Mr. J. A. GREENE (for the West Riding County Councils' Association, comprising 81 urban districts and 13 rural districts not members of the Conference), witness saw no justification for the rates of those districts being pledged as security for any part of the proposed undertaking. He agreed that these councils were justified in being distributors but not generators. The present was a bad time to spend capital, and postponement might be advisable. As to co-ordination without buying out the company, at one time Leeds had contemplated interlinking without the capital station, but the prospective demands indicated the coming need for such a station. A linking-up scheme would require more capital at present than the Leeds scheme, and linking-up would not serve very long or lead to much conservation of capital expenditure. He admitted that linking-up had much to commend it even now, and that councils would be more disposed to raise money for something of their own and linking-up than for either the Leeds or Conference scheme. Nobody could estimate with certainty the future demand, owing to the state of general commerce, but as things stood he favoured the Leeds scheme as being the most conservative estimate. In response to pressure by Sir Harry Haward as to the absence of provision for even a temporary deficiency in funds in the Leeds scheme, witness said such deficiency was meant to be carried forward until the time when growing business would pay it off. If the scheme failed to survive the test of avoiding rate aid from anybody, the Leeds Corporation would be well advised to drop it. They had not been asked to consider providing a clause under which a deficit might be a call upon the revenues of undertakings taking electricity, but personally he saw no objection to it provided that the price paid for the energy was not so hopeless as to make the thing provocative. The idea was that the deficiency, if any, should be capitalised for the time being and covered by the Ministry's advance.

Sir Harry said he did not consider that clause covered the point.—Mr. Collins, in answer to further questions, did not think Leeds would be prepared to proceed with its scheme on so low an advance as five years' period. As to the ability of the authorities to borrow the several millions involved, the secret of the whole thing was how far they would pledge their rates. Private enterprise alone might not get the money at less than 7½ per cent., private enterprise supported by local authorities without pledging rates at 6½ per cent., and if the rates were pledged the money might be obtained as low as 5½ per cent.

Mr. WOOLL intimated that his case for Leeds was closed.

THE CONFERENCE CASE.

Shortly before the adjournment Mr. A. T. MILLER, K.C., opened the case for the Bradford Conference scheme, which was resumed on Saturday morning. Mr. Miller said he recognised, as Mr. Wooll had mentioned, that agreement was really an essential of any proper and satisfactory future development in the area, but he by no means started with any feeling that agreement was not to be hoped for in favour of the most business-like and most profitable scheme for the district. Looking broadly at the present position in the West Riding, it was a problem differing essentially from those which had had to be solved in West Lancashire and North Wales and Chester. In all the cases the existence of a power company had had to be faced, and in the West Riding there was a large development of local-authority production of electricity. There were eight distinct methods of supply in the district at present, all intermixed and all within the Power Co.'s area. Furthermore, the Power Co. itself extended its operations on the north along a fringe of districts beyond the Aire and Calder District area. In that area there were districts taking entire supply and distribution from the company; other districts took only bulk supply and did their own distribution; there were districts for which provisional orders had been obtained which were not yet operative; districts depending wholly on their own generated current; others upon energy supplied by authorities other than the company; districts taking bulk supply from borough authorities and doing their own distribution; others taking part of their supply from the company in bulk and part from neighbouring borough authorities and doing their own distribution; and others which had not yet any system at all. He desired to emphasise the extreme complication of the position. There was a rich industrial area, providing a most important field for development; a district in which many active municipalities had their own electrical developments and which had had the advantage of the Yorkshire Power Co.'s operations in the past. All this complication led up to a position which was just that condition of affairs which the Electricity Act of 1919 was intended to enable the Commissioners to unravel, of course with the agreement of those interested. The three solutions before the inquiry appeared to him to be arranged somewhat in a rising scale of evolution. They started with the Power Co., which had proposals which seemed to be a sort of policy of despair. It wanted to be left to develop in its own way, and the most it could suggest was interlinking. Leeds proposed a Joint Authority to leave the Power Co. at any rate for the present; and the Conference scheme was for entire public ownership and control of the generating stations and main transmission lines throughout the district. The three proposals seemed to represent stages of the rising appreciation of the intentions of the Act.

Mr. Miller then dealt with the broad principles of the Conference scheme and the manner in which it came into being. He claimed that the Conference body was actually the direct descendant of the original conference called by Leeds on publication of the formal notice of the provisional determination of the area by the Commissioners, and that it was the Leeds authority which had fallen away some six months after the first conference. He suggested that the letter in which Mr. Hefford, the Leeds engineer, intimated the Leeds differences with the other bodies in the conference, indicated that he was willing to work in harmony with the other authorities so far as possible, and seemed as though he might be prepared to modify his views. In August last the Bradford town clerk, on behalf of the Conference, reported to the Yorkshire Electric Power Co. the decision of the conference in favour of a Joint Authority comprising only elected representatives of the people, and asking whether the company would be prepared to offer terms for the transfer of its undertaking. The company replied, not unnaturally perhaps, that it was not prepared to offer to sell out to an authority which did not yet exist, and whose constitution had not been settled. Mr. Miller contended that the tone of its letter indicated that it had not given a final and definite refusal to negotiate at any future time. In fact, it seemed to leave the way for negotiations open, thereby indicating that it had in mind the interests of the community at large. That gave him reason to hope that should the Commissioners direct that the interests of the public could best be served by public control, the company would be prepared to consider transfer of its private undertaking on proper and reasonable terms.

Though Mr. C. N. Hefford had had to leave the Conference engineers owing to the views of Leeds, he had given great help up to that time, and had continued to furnish any information required. The Conference engineers appreciated his co-operation. Proceeding with the history of the drafting of the Con-

ference scheme and engineers' report, counsel said the original Conference Committee had invited the co-operation of local authorities which were distributors only, as well as those which were generators, and had secured support from some of them. He called attention to the comparative weight of electrical output by the authorities supporting the Conference scheme, as against that of the other sides to the inquiry. During the year ending March, 1920, Leeds had generated, roughly, 76,500,000 units, the power company 50,000,000 units, and the local authorities which had passed definite resolutions in support of the scheme some 120,000,000 units, or about 46 per cent. of the whole output. These authorities had an experience averaging since 1897, as against the Power Co.'s commencement only in 1904, and therefore not only had they the largest stake in the area, but also a record of achievement which augured well for public control in the future. The facts showed how strongly was the principle of public control held in the area. Any objection of the company to transfer was met by the proposal that the entire undertaking, including part outside the Aire and Calder area, should be bought, at a fair and full price by agreement, or, failing agreement, under the Arbitration Act.

Questions were raised by the Commissioners as to what was to happen to the portion of the company's undertaking outside of the Aire and Calder area, if the Joint Authority took the whole undertaking.—Mr. Miller held that though the situation depended on the passing of the No. 2 Bill, adjustments, and the settlement of the North-East Midlands District Joint Authority, the general policy of the Authority in the latter district indicated the probability that arrangements could be made for that Authority to take over the parts outside of the Aire and Calder district. This should not be a matter of difficulty, as there were no big generating stations in that outer portion. He agreed with Sir Harry Haward that the point was *ultra vires* except by consent, and said the scheme was not put forward with a view to asking for compulsion on the company; they wanted agreement, and every generating authority in the area, except Leeds, supported the scheme. Counsel contended that there were no special circumstances in the area which justified departure from the general rule, established by the opinion of the national coal conservation and electricity supply committees, that public control of generation and main transmission was desirable in the national interests. The Conference took the view that this principle was the best from the business point of view, the engineering point of view, and the point of view of development.

Dealing with the estimate of capital expenditure under the scheme, Mr. Miller called attention to a correction in the column of working capital brought forward in 1931 in the financial tables. The figure should be £260,000 instead of £170,000, thus altering the total to £8,983,994.

Sir John Snell suggested that the key to the whole scheme was missing—the actual capital commitment involved in the acquisition of the Power Co.'s undertaking. This was necessarily an unknown figure.—Mr. Miller admitted that, but said the Conference was confident on its figures, which had been accepted, that by the saving gained from co-ordination a cheap and good electricity supply could be secured and would leave a margin of profit which would meet the charges on the capital outlay. Excluding the sum necessary to buy out the Power Co., the figures of the Conference scheme showed a greater saving than either the Leeds scheme or the linking-up proposal. With reference to the proposed purchase, counsel said the Conference had taken as a basis a price of supply of 1d. per unit at the busbars at centres and sub-centres for high-pressure untransformed energy. There would be some little addition for subsidiary distribution to get at the actual price, but taking the 1d. as the estimated outlay, the working costs, excluding charges on the purchase price of the acquisition and the cost of authorised extensions by the company, left a surplus in the year 1926 of £280,170, which the promoters regarded as more than sufficient to meet the purchase charges, the latter being based on the capital of the company at the year ending December, 1920. In 1925 the Conference scheme showed a surplus, on 1d. price, after paying capital charges on the estimated purchase price, of £51,370, as against the Leeds tables showing a deficit, at 1d., of £603,930, and he believed Leeds proposed a higher price in order to meet the difference. He admitted that the figures were largely problematical, in view of the unknown expenditure on purchase. Concluding his opening of the Conference case, Mr. Miller drew attention to the technical differences between the Leeds and Conference schemes, particularly as to sites and times of erection of the new stations. The Conference regarded the proposed Leeds site as totally inadequate. The Conference scheme achieved a substantial estimated saving of coal by centralisation and the finance officers of all the authorities in the scheme had approved the financial clauses of the general provisions of the scheme.

Sir Harry Haward asked whether the principle of public control meant total exclusion of any representative of an electrical company, or would be satisfied with a controlling majority of elected public representatives.—Counsel said he felt that the clause as drawn up did not go so far as total exclusion. Any companies in the area were, of course, authorised undertakers.

The inquiry was then adjourned until Monday, May 23rd.

(To be continued.)

The Lower Severn Electricity District.

Joint Authority Scheme Abandoned.

A resolution that was passed unanimously at a meeting of the Organising Committee (of which Mr. H. Faraday Proctor, engineer and manager of the Bristol Corporation Electricity Department, is chairman) on February 3rd, 1921, stated that the Committee, whilst still desirous of proceeding with the scheme to set up a Joint Authority for the district, having regard to the almost insuperable difficulties of conforming to the requirements of the Commissioners (bearing in mind the limitations of the probable electrical requirements of various portions of the district) especially in relation to the impossibility of restricting representation to those who are willing to assume financial responsibility; and the necessity for the presentation of an engineering scheme of development embodying an undertaking that portions of such a scheme shall be carried out by dates to be determined, was of the opinion that it was unable to proceed with the scheme submitted so as to present it in accordance with the requirements before referred to.

Mr. Proctor explains that the sending out of the following information (which we received on May 26th) has been delayed, at the request of the Electricity Commissioners, to enable further endeavours to be made to secure such assurances from the Forest of Dean Colliery Owners' Association as would enable the scheme to be proceeded with on the original basis. The Association not being in a position to give the required assurances, it has been determined that no further action be now taken. He comments as follows, *inter alia*, upon the present position:—

The Organising Committee has always been of opinion that the district (with the exception of one portion specially dealt with) does not present features showing that a scheme of centralisation would result in very decided financial advantages in the near future. Practically the whole of the district is agricultural, there being few areas in which an industrial load or other substantial demand would arise; therefore, the most desirable course to be pursued in connection with the district, is to leave the engineering proposals for reorganisation in abeyance until the organisation for controlling supply and other matters is set up.

Since a complete scheme could not be adopted at present, as essential financial clauses are generally considered to be *ultra vires*, the inquiry * was deemed to be of an interim character.

The Organising Committee did not, therefore, deem it necessary to engage counsel, and the Commissioners were so advised on December 17th, 1920. Additional information was furnished to the Commissioners at their desire subsequent to the submission of the scheme. The Commission, on December 1st, 1920, stated: "You are correct in assuming that it is only the 'scheme' which need be available on application and not the additional technical information furnished by you in subsequent memoranda." But on the morning of the inquiry surprise was expressed that counsel had not been engaged, and that the "additional technical information" had not been circulated to all parties.

Mr. Proctor has good reason to believe that, unless financial responsibility is imposed upon all authorities and bodies represented on the Joint Electricity Authority, authorities of importance will decline to assume such responsibility, and it appears likely that as a result voluntary financial responsibility will disappear altogether. The chief object in requiring financial responsibility to be assumed *pro rata* with voting power, is to secure cheap money by giving the best security. If this is, as indicated above, impossible, an increase of not less than, say, 3 per cent. should be allowed for in the rate of interest on capital. Opinions have been expressed that the additional rate should be 4 or 5 per cent., and that money would not be forthcoming at any price.

The power to require "standardisation of systems" rests entirely with the Commissioners. The Joint Electricity Authority can only act by agreement or through the Commissioners as regards "methods of charge to consumers." If this reference is restricted to the charges to be made by authorised distributors as distinct from those to be made by the Joint Electricity Authority, the matter would not appear to be under the control of the Joint Electricity Authority. In Mr. Proctor's opinion no authorised undertaker or other consumer should be placed in either a better or worse position as regards the price at which he is supplied, on account of the position selected for the location of any generating station, but a difference is justified according to the locality in which the supply is required as affected by other considerations, such as the total demand in the locality, the nature and density of the demand, and other considerations which might have affected the price of supply furnished from any other source than the Joint Electricity Authority. Thus, a demand arising in or near a purely rural area should be furnished on less favourable terms than a corresponding demand in or near an industrial area. This principle does not appear to be followed in the schemes put forward in respect of the Chester or the Mersey Districts wherein a uniform standard is advocated.

The Organising Committee decided that it was inadvisable to put forward engineering proposals other than those connected with the interim works to be carried out by the

* Elec. Rev., Jan. 14th, 1921, p. 58.

Minister of Transport for the furnishing of a supply to the Forest of Dean, with transmission lines extending in the direction of Gloucester. The Commissioners, however, pressed for the submission of a scheme for connecting up Bristol, Bath, and Wiltshire towns, and Mr. Proctor informed the Electricity Commissioners, "I purposely refrained from dealing with the supply of considerable portions of the district on the lines of any centralised scheme, and particularly the district of Bath and other places beyond, as I have felt that there is very little that can be put forward in support of the same at the present time." However, on November 22nd, 1920, "additional information" was prepared, embracing detailed estimates dealing with capital and revenue, also tables of statistics and diagrams, &c. For a bulk supply to be given at Bristol, Bath, Bradford-on-Avon, Melksham, Trowbridge, Frome, Radstock, and Pensford, the financial results ascertained show that no case can be made showing economies resulting from this section of the scheme (on the estimates of demand submitted), if an additional 3 per cent. be added to the annual charges on capital account due to the absence of the backing of the rates of local authorities.

If Bristol is considered separately, the result is not only a disappearance of the saving, but the creation of a direct loss, for instead of extending its existing generating station, Bristol would construct a new generating station, on the lines of the proposed capital station, to furnish its additional requirements. Mr. Proctor's figures suffice to indicate the attitude of the Organising Committee in not committing itself to any definite engineering programme, and indicate the probability that local authorities and others would decline to do so.

The Organising Committee much regrets that it is still of opinion, after having made further investigations, that it is unable to proceed with the scheme, so far as it relates to the supply of electricity, so as to present it in any different form from that in which it was originally deposited, but it is prepared to proceed with the original scheme on receiving satisfactory assurances from the coal owners in the Forest of Dean, which assurances it has not yet been able to obtain.

The results have throughout confirmed the views consistently held by the Committee that, apart from the northern section of the district (embracing the Forest of Dean, Stroud Valleys, Gloucester, and Cheltenham), whilst certain advantages might accrue from the formation of an organisation to "father" development within the area, with power to carry out developments as and when commercially practicable, if such is not permissible, no alternative can be suggested on a sound commercial basis at the present time.

THE PRESENT ECONOMIC POSITION OF THE ENGINEERING AND ALLIED INDUSTRIES.

(*Concluded from page 695*).

A Slander on the British Workman.

It is to be regretted that, in the persistent desire to "create atmosphere" and to put the fear of starvation into the workmen's minds, the employers' pamphleteer does not refrain from libelling the British engineer. "The great misfortune," we are told, "is that, at present, for a variety of reasons, the productivity of British labour is "—not merely "below its pre-war standard," which might be arguable and explicable, but also "below that of workmen in competing countries." Not the slightest evidence is adduced for this astounding libel on his fellow-countrymen. What can the writer mean? Probably all that he meant to express was that the British workman does not work continuously at as high speed as the employer thinks that he ought to do—to put it bluntly, that on time rates he does not give piecework intensity. This, let it be clearly understood, no workman ever contracts to do. But this misconception does not excuse the libel. Does the pamphleteer seriously contend that the average fitter or erector, turner, or toolmaker in Great Britain is less skilled than the Belgian or the German fitter or erector, turner, or toolmaker, or that, taking the year round, he produces less in quality and quantity? In which case, we would ask, why are British mechanics asked for by employers in other countries? and why are they constantly being tempted to go abroad to take situations at much more than the earnings of the local engineers? Even in the United States the British engineer is in demand. It used to be said that foreign mechanics worked longer hours than British. This, however, whatever it was worth, has ceased to be true. The eight-hour day has become practically universal. It may quite well be true that, on a repetition job, with foolproof machines, a far greater quantitative output may be got out of some Continental operatives, as was found when the Belgians were in this country. But the fact that no employer having engineering work of first-rate quality to do ever engages a foreign workman when he can get an English or Scottish engineer, with all his faults, indicates how little ground there is for this careless slander.

Wages and the Cost of Living.

The pamphlet states (pp. 22-3), actually enough, the rise in the cost of living, and the extent to which it has begun to decline. But again, the attempt is to "create atmosphere." It is predicted that the cost will rapidly fall—it is suggested to no more than 66 per cent. "above the pre-war level," a fall which any "decline in wage rates will accelerate." Now, if we take the money earnings of all grade of engineers as being now (April, 1921) at somewhere between 100 and 150 per cent. above pre-war level, the suggestion that we can confidently expect the cost of living to be, very shortly, no more than 66 per cent. above the pre-war level, means, once more, an insinuation closely resembling the one that *wages are to be halved*, which is almost exactly what the South Wales miners are being told! . . . .

The Export Trade.

Something like half the engineering industry works for export. Why is the foreign demand for engineering products so slack? Let us take the countries one by one.

To Russia we used, before the war, to sell some millions of pounds' worth of engineering products, an amount which at present prices would be at least double. Russia to-day is hungering for locomotive engines, for electrical plant, for agricultural implements, for machine tools, for motor-car components, for textile machinery, and, in fact, for nearly every kind of mechanical appliances. Surely the employers will not contend that any appreciable reduction of price would make any difference in this case? So urgently does Russia (which is badly off enough owing partly to our continued blockade) need these things, that the Soviet Government is prepared to buy them for gold and platinum paid down on shipment. For more than two years the British Government (which nearly all the engineering employers voted for, and still support in office) has actually forbidden this profitable trade, which would have kept thousands of British workmen in employment, and would now find them work for years to come. Even now obstacles are put in the way, legal proceedings are threatened, and trade with Russia is still a "wash-out."

To Germany we used also to sell annually millions of pounds' worth of engineering products, worth at present British prices at least double, and in German currency 24 times that sum. Is it suggested that it is the high prices quoted by the British engineering employers that have prevented exports to Germany? For over two years the British Government, dragged at the heels of the insane desire for vengeance of the French Government, has put every possible obstacle in the way of the restoration of prosperity of German industry. Nor is it only the British Government. Many a British employer has felt with the Right Hon. W. Runciman, late President of the Board of Trade, that "we have got Germany down, and we won't allow her to get her head up again," or words to that effect. However natural may be such primitive feelings, they do not make for a revival of international trade. We are members one of another. British industry cannot be restored to full prosperity unless other countries are prosperous. We do not gain by ruining our customers. The engineering employers themselves expatiate on the great difficulty created by the depreciation of the German mark. *This depreciation is being to-day increased by the action of the British Government*, still supported by practically all the representatives in the House of Commons of the Federation of British Industries (to which so many engineering employers belong) in endeavouring by extraordinary Customs duties to prevent the German export trade. How can engineering employers expect to see their own export trade to Germany revive so long as this extraordinary policy is persisted in?

To Poland and Bohemia, Austria and Hungary, the Balkans and Rumania, we used to sell every year many hundreds of thousands of pounds' worth of engineering products. These countries are to-day terribly in need of machinery of every kind. Their currencies are so depreciated that our British employers complain that export sales are rendered almost impossible. Will it make business easier to effect if the depreciation of the krone and the leu is actually increased by the practical prohibition of their exports to this country (and to as many of the countries of our Allies as we can induce to take the same suicidal course)? For this is what is involved in the proposed new British Customs duty of 33⅓ per cent. on imports from countries having depreciated currencies.

Now, the British engineering workmen do not believe that, so long as these evil *political* restrictions on trade are continued, any reductions in the price of British products will avail to restore our international trade. So long as trade is actually hampered by blockades and embargoes, 50 per cent. duties on exports from Germany, and 33⅓ per cent. duties on imports into Great Britain from nearly all the continent of Europe, *reductions in price are simply thrown away.*

When the employers ask the workmen to co-operate in effecting such a reduction in prices, it is obvious that the preliminary answer must be that the workmen would be fools to take any step in that direction until the British engineering employers first insist on the British Government adopting a policy of peace and free trade, with a sincere desire for the prompt restoration of prosperity of the whole European continent. *The only way to increase our foreign trade is by adopting a policy of peace, the restoration of Europe, and free trade.*

The Home Market.

But our foreign trade is, to the British engineering employers generally, only half their normal business. How can we give a fillip to that other half which is with the Home

Market? Clearly not by cutting down wages, the effect of which is, by exactly the amount of reduction, to restrict the home sales of British manufacturers generally. So long as British employers pursue this policy, in one industry after another (which is what the workmen mean by "a conspiracy to force down wages"), trade will get worse and worse, so far as the Home Market is concerned.

It may be that the British engineering employers are justified in believing that, if their cost of production could be reduced (and, *what does not always follow*, if they gave their customers the benefit of such a reduction by a corresponding fall in retail prices), more engineering products could be sold. It is their business to judge of such a fact. If motor-cars and bicycles, gramophones and agricultural implements were considerably cheaper, *without anybody's income being lessened*, more of them could be sold. If it cost less to put in new machinery and electrical plant *without any lowering of purchasing power*, more would be installed. But even on the employers' own showing the reduction in price must, to be effective, be substantial. Now, in the engineering establishments the wage bill is often reckoned at half the gross value of the output. On p. 20 of the employers' pamphlet it is incidentally given as no more than 27 per cent. of the gross value of the output. Taking the intermediate estimate of 40 per cent. of the gross value of the output, it would need a cut at engineering wages of no less than 50 per cent. in order to enable the product to be sold even 20 per cent. cheaper. Do the employers suggest that a cut of 50 per cent. in wages is going to leave the Home Market as large as before? Is it not evident that the very argument in favour of lower prices increasing demand depends on the assumption that purchasing power is not reduced? It may be desirable to bring about a reduction in the cost of production if it can be done without reducing income. But it is simply suicidal to seek to develop the home trade by reducing the incomes of the mass of the people.

Now, it is an extraordinary fact that from the beginning to end of the employers' pamphlet no possible means of reducing the cost of production is mentioned other than a reduction of wages.

Is this honest? Is it consistent with the claim (p. 25) to set before their workmen "a comprehensive and reasoned statement of the case"?

Lowering the Cost of Production.

How can British engineering employers reduce the cost of production without reducing anyone's income? First, they have to get their materials at the lowest possible cost. Will they be lowering their costs by allowing Mr. Lloyd George's Government to clap on 50 per cent. duties on all German exports, which ought to include (as they did before the war) iron and steel, timber, and various components? Will it make timber and leather, lubricating oil and platinum cheaper to the British engineering employer to permit Parliament, by a general import duty of 33⅓ per cent. to raise the price of all the raw materials and components that come from Russia, Poland, Germany, Austria, Czecho-Slovakia, Hungary, Rumania, and the Balkans—not to mention India, Belgium, and France—which is what is actually being proposed? The workmen have a right to raise such questions when they are asked (p. 25) to "co-operate" in reducing the cost of production. Are the British engineering employers taking all the necessary steps to prevent their cost of production being actually increased? *Or are they inviting the workmen to make up by still further reductions of wages for the increase in cost now being artificially produced?*

Reduction of Workshop Costs.

But apart from these extraordinary proposals to increase the British engineering employers' cost of production, against which it is to be hoped they are vigorously protesting, are there no steps to be taken in their own establishments by which unnecessary expense could be saved?

On this point it is difficult to speak without seeming to be impertinent, and without giving offence. But the employers ask, in effect (p. 25) for a "frank exchange of views," and it would be discourteous not to explain to them what the workmen feel on the matter. *The British engineering industry is, with few exceptions, badly organised from one end to the other.* And this is taking no ideal standard, or theoretical perfection. Compared with many American establishments, and even with the best in this country, the great majority of British engineering workshops are badly laid out, often badly lighted, inadequately equipped, and, many of them, wastefully managed, with the result that time and materials are not used to anything like the greatest advantage, and costs are (without advantage to the workmen or anybody else) unnecessarily raised.

What can the mere workman know about such things? Well, let us call in an authority in matters of engineering, whose capacity to judge no one will dispute—Mr. Michael Longridge, late President of the Institution of Mechanical Engineers. Speaking to the employers themselves and their managers no longer ago than April, 1917, he declared that: "Except in a few cases, workshop organisation here has not received the attention given to it in America or Germany. There are still shops without definite planning of the progress of the work, without adequate equipment of jigs and gauges, and without standard shapes of tools or a tool-room; where men drift about in search of tools or tackle, or wait in idleness for drawings and materials; where machinery is obsolete and lights so bad that good work cannot be done if the machinery is up to date. Such shops must go. They cannot compete in price or quality of work with those in which, what is known as 'scientific management,' or anything approaching it prevails; where the progress of every job is planned to the last detail before it is sent into the works; where machinery is so arranged that each piece passes through the whole series of operations to be performed in its pre-determined order and without pause, and is immediately succeeded by another piece to undergo the same cycle of operations; where labourers and tackle for fixing the work are ready the moment they are wanted; where drawing gauges, and tools properly ground to standard shapes come with the work; where cleanliness, light, and comfort reign, and where an endeavour is made to get the workman to regard his task more as a problem to be solved than as a task to be got through."*

Every employer who reads this very authoritative description of British engineering as a whole will probably resent it as a description of his own establishment. But let him reflect candidly on what he has seen in other engineering establishments, which he can judge with more impartiality, and we do not think he can deny the indictment of the President of the Institution of Mechanical Engineers. "Conscious as we are of each other's infirmities," he must admit that many of the engineering workshops that he has had occasion to visit fall far behind, in efficiency, those which he considers the best.

It is these defects and deficiencies in the manner in which the British engineering employers have laid out and equipped their workshops, and the state in which these are allowed to continue year after year, *that the workmen are now invited to make up for in reduction of wages.* The employers assert that what is hampering them is their high cost of production. *To seek to lower wages without first stopping the employers' waste is to make the workmen pay for that waste.*

The Waste of Fuel.

For an instance of faulty management not alluded to by Mr. Longridge, take the one item alone of coal consumption, which is a standing charge of no small magnitude. As recently as 1919 the very expert and highly practical Fuel Research Board reported that fuel was being wasted by British manufacturers to an almost incredible extent. "In the majority of industrial undertakings," it was declared, "a reduction of from 5 to 20 per cent. could be secured within a year at a relatively trifling expenditure on wages and small alterations of apparatus."

A reduction of 5 or 10 per cent. in the coal bill would be worth a great deal. Why not secure it?

Railway Rates.

Or consider how greatly the cost of production is at present increased by the heavy expense incurred by many engineering establishments, owing to their location, in the heavy charges for carriage on materials and coal inwards, and for carriage of their products outward, at railway rates extraordinarily high in comparison with what their American, Belgian, German, and French competitors are paying. Is it part of the claim of the British engineering employers that, because their works are badly located, or because they have failed to use their political power to get these railway rates reduced, or to secure the alternative of an efficient canal system, the engineering workmen are to make it up to them by accepting lower wages—a course which would be suicidal so far as the Home Market is concerned, because it would be restricting the very demand that it was intended to stimulate? Would it not be better to see what can be done to reduce the high railway charges by which, as employers themselves have often declared, British industry is handicapped?

The Burden of Tribute.

Finally, there is the delicate question of the extent to which British engineering industry is charged with rent, interest, profits, and managerial salaries. It is sometimes argued—indeed, it is implied in the very pamphlet under consideration (p. 20)—that "profits alone represented but a small percentage of turnover even though in the aggregate a large sum"; and that "two very large firms . . . . showed proportion of wages to profits of about 10 to 1 in one case and about 12 to 1 in the other." This is a very naive and simple error. What is intended to be implied is that the poor capitalist is getting next to nothing out of the business, and that nine-tenths or eleven-twelfths of all the net proceeds go to the workmen. The workmen, of course, know better—know, in fact, that according to the best available statistics, only about two-fifths of the national income goes in the wages of the manual workers, who constitute with their families more than four-fifths of the population. The fallacy of the other view lies in excluding from "profits" all rents and royalties; all interest on loans and debentures; all allocations to reserve for equalising dividends; all the various "hidden reserves" that are periodically distributed as bonus shares; and, finally, the sums paid to directors and managing partners. It is not contended, of course, that the directors and managers can be expected to work without a livelihood. It may even be necessary to remunerate people for the act of saving capital in order to invest it; though not neces-

* Mr. Michael Longridge (presidential address to the Institution of Mechanical Engineers, April 20th, 1917), quoted in "The Works Manager To-day," by Sidney Webb, 1918, pp. 134-5.

sarily to reward them with perpetual annuities for their original act! It is, of course, not practicable for any firm immediately to free itself from the burden of rent, &c. But it may well be that some particular establishment, or even the British engineering industry as a whole, finds itself saddled, by inheritance from the past, with a dead-weight burden of rents and royalties, or loan and debenture interest—even of "capital" watered by bonus shares—which its present business is unable to bear. At any rate, it is plain that it would be necessary to make the amount of this "dead-weight burden" (for which the workmen clearly have no liability) a subject for statistical investigation, before the allegation that there was no profit, or every little profit, left for distribution as dividend to the ordinary shareholders could be accepted as having any bearing on the question of whether the industry could or could not continue to pay its present wages. It may be that the burden of the tribute which industry pays to ownership will have to be reduced. When a company finds itself "over-capitalised" it has to "reconstruct."

CONCLUSION.

Only one word need be added. It will be seen that, in the workmen's view, the employers' pamphlet is far from being the "comprehensive and reasoned statement" that it claims (p. 25) to be. It does not afford any of the statistical data necessary for the "frank exchange of views" that the employers invite. It gives neither the amount of their costs nor that of their sales, still less does it afford any analysis of the several items; so that it fails to present even the beginning of a case for any reduction of wages. The employers are invited, in reply, to put their cards on the table. If they claim that their industry is, at the existing rates of wages, actually insolvent, let the figures be produced and authenticated which prove this to be the case; and let some explanation then be given of the current Stock Exchange quotations for their shares.

When this is done the Conference could next inquire under what difficulties the export trade now suffers and by what means it could be increased—leading, it is suggested, to issues of foreign policy and fiscal changes, which it would be necessary to explore. The Home Market, which is of such great (and possibly growing) importance to the engineering industry, could then be considered, when the employers would doubtless afford the statistical material for an examination of the growth of the several branches of this trade, and would explore the hindrances to its further development.

In so far as it seemed useful, for the sake of increasing sales, to reduce the cost of production, inquiry could then be made how this could be done, without anything so suicidal as a reduction of wages. Such matters as the circumstances enhancing the price of materials and components; the wasteful consumption of fuel; the disadvantages of workshop location, equipment, lighting, and organisation; the burdens on the industry such as railway charges, local rates, rents, and interest, &c., would be relevant.

In a "frank exchange of views" on these subjects, the representatives of the workmen would gladly co-operate as invited.

NOTES ON ELECTRICITY IN SWITZERLAND.*

As is the case in England, Switzerland has suffered in the past from too great a variety in the systems adopted for the supply of electricity. During the great European war, however, great strides were made in the direction of standardisation in that country.

The new standard of distribution is three-phase with a periodicity of 50 cycles and the normal supply is at either 127 volts, 220 volts, or 381 volts, and in certain special cases 660 volts. For railway work, the single-phase system is standardised, with an overhead collector at 15,000 volts and a frequency of 16⅔ cycles. For town and suburban tramways direct current is used at 600 or 1,200 volts; and 2,400 volts in the country extensions of the tramways.

The two-rate system of charging, with clockwork change-over meters, is almost universally employed. During the period of maximum demand the rate charged for domestic purposes is from 40 to 60 centimes per kWh. During the remainder of the day the charges vary from 15 to 25 centimes per kWh.

One of the first extra-high-pressure transmission systems in the country is now in course of erection. The system will be operated at 135,000 volts, and is intended chiefly for connecting up the large power stations, though, in addition, it is also proposed to export electric power to neighbouring countries. The principal electric power stations in Switzerland are the Nordost-Schweizerische Kraftwerke at Baden of about 120,000 installed turbine h.p. (not all available owing to lack of water) and the Bernische Kraftwerke at Berne of about 110,000 h.p.

It is an interesting feature, that the Swiss power stations have the most power available in the summer months and not in the winter. This is due to the fact that the water supply is obtained from the melting snow. More attractive rates are accordingly offered to summer customers, including farmers. Most of the power stations are in a very awkward position this year on account of the lack of snow during the past winter; river beds are drier than they have ever been in the recollection of the present generation; and lake levels have fallen to such an extent as to expose the remains of old-world villages and monuments. The power stations already have had to announce considerable restrictions in the supply to customers. In the lower part of the Engadine valley, steam locomotives are being used, owing to lack of power for the electric locomotives, which supplanted the steam engines a few years ago.

In agriculture, very great progress has been made in the various applications of electricity. This evidently has been the case in nearly all the non-belligerent countries during the great European war. Electric motors are used extensively in the farm buildings; as an illustration of this it may be mentioned that at the beginning of the war 250 electric motor installations were in use on farms around Lucerne—to-day over 1,000 farmers in the neighbourhood of the city are using electric motors. The size of the motor employed is chiefly 3-h.p., three-phase, 50 cycles; the normal range of sizes being from 2 to 3 h.p. This is much smaller than the average size of motor employed by Danish farmers, which is 10 h.p. These motors are usually of the portable type, in which case the starter is very neatly and compactly mounted on the top of the motor. The motor is connected to the source of supply by 12 metres of 4-core flexible cable, one of the cores being the earth wire. The motor is either fitted with a pair of metal stretcher bars to enable it to be transported by two men, or else it is mounted on a small truck. While each farmer owns his own electric motor, it seems quite a common practice for several farmers to combine to purchase the machines to be driven by these motors, such as root-pullers, chaff-cutters, and the like. This is contrary to custom in other countries, except in the case of large machines, such as thrashers. Some very important experimental work in connection with the drying of hay has been carried out by Herr Director Ringwald of the Central Schweizerische Kraftwerke, Lucerne. However, its adoption by farmers is only just commencing. It may be mentioned that the chief credit for the development of applications of electricity to farming in Switzerland may practically be all ascribed to the initiative and energy of Herr Director Ringwald. The possibility of obtaining a supply of electricity on the farms has caused a number of farmers to start up various rural industries, such as cider making. Some of the larger cider makers are employing electric vehicles for the transport of their cider and general farm produce. Very little has been done in Switzerland in connection with the application of electricity to agriculture for work outside the actual farm buildings. This is largely due to the fact that there are no very large farms in the country, in fact, the owner of a herd of 30 cows or of 100 hectares (250 acres) of land is considered to be a large farmer. Further, the practice of growing fruit trees out in the fields amidst the crops almost prohibits electro-mechanical ploughing and cultivation in many parts of the country.

Electro-culture of crops has only been carried out on a small experimental scale at Lucerne by the aid of a Tesla transformer operating at 20,000 and at 30,000 volts. Offers have been made to local farmers of a free trial installation, but so far nobody has been found enterprising enough to take up the matter, although the preliminary experiments were so successful. Electric pumps for the irrigation of fields and also for distributing liquid manure are in use on quite a number of farms. Electrically heated incubators have established themselves as successful pieces of apparatus, and there are at least two companies manufacturing them. Freehold pole rights are easily obtainable nowadays on payment of from 10 to 30 francs for ordinary poles, and about 50 to 100 francs for a tower.

Altogether Swiss electrical manufacturers report a very big business in the supply of electric motors and other apparatus specifically for use in agriculture. Of course coal and oil have been and are very expensive and difficult to obtain; but on the other hand, the prices charged for electricity to farmers—according to English ideas—are very high. The underlying secret of the success of electricity is very evident not its cheapness as a form of power supply, but rather the discovery by farmers, that it is so very much more convenient, economises labour, and accomplishes better work than any other method.

* Written by R. Borlase Matthews, M.I.E.E., &c., for the E.D.A.

Chalk as Fuel.—Recent advertisements in the daily Press have drawn attention to a new fuel, of which the essential constituents appear to be chalk and cinders, blended with a "rich carbonaceous material," the invention consisting in certain secret processes. To engineers we need not say another word on the subject. We note, however, with a sense of relief, that the financial experts are giving a very cool reception to the prospectus, and are criticising the offer severely. While they do not touch the matter on the chemical side, they find ample scope for criticism in the prospectus itself, and after reading their comments, even the most ardent investor with money to burn will have only himself to blame if he cannot keep it in his pocket.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Reflex" Pendulum Control.

When unification of workmen's registers was first attempted, the electric clock maker proceeded to do so by substituting for the spring-driven clock work, an electrical step-by-step or impulse movement. Such a substitution avoids the necessity of winding, but introduces other troubles, because the comparatively low power of the impulse movement leaves little margin for stiff places which occur in the clock mechanism from time to time as the register is used.

The next step to overcome some of these possibilities was to "scape" the existing mechanism electrically. By this method the pendulum was removed, and an electrical scaping mechanism substituted, which, operating every half-minute by means of the time circuit, allowed the clock train to run on in half-minute intervals. This principle is sound and practical, but still it does not remove the possibility of a stoppage if the time circuit is interrupted.

In the "Reflex" pendulum control, made by MESSRS. GENT & CO., LTD., Faraday Works, Leicester, nothing is removed from the register, but an addition is made thereto in the form of the "Reflex" control mechanism. This consists of two main parts, one the "vibrator," which is clipped to the pendulum rod, no drilling or tooling being necessary. The other part, or "stator," is screwed to the woodwork of the register by wood screws or by nuts and bolts, as may be desirable. The register is "wound up" in the usual way. It operates by the clock work exactly as supplied by the maker, but by the "Reflex" movement, the pendulum is compelled to keep time with the transmitter controlling the time circuit of the factory and the other clocks in the circuit.

The pendulum should be so rated that the clock does not "gain." It must be given a slightly losing rate, but need

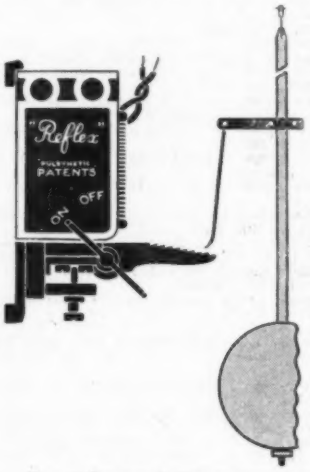

FIG. 1.—THE "REFLEX" PENDULUM CONTROL.

not be set to lose more than two minutes per day of 24 hours. So effective is the "Reflex" control that, in a pendulum beating 88 per minute, as is the case with some of the best-known makes of recorders, it will effectively deal with a loss of as much as ten minutes per day.

Among the advantages claimed for the device are that it can be removed entirely in five minutes, and if the electrical time circuit is thrown out of commission, the register does not stop, but carries on as a separate mechanical unit, and is not affected in any way except that it is no longer under electrical control, so that this does not materially interfere with the costing and checking system.

We are informed that many firms have already adopted the "Reflex" control on their existing time circuits.

A Corrosion-proof Switch.

There has always been great difficulty in designing a switch which will be efficient in operation, strong and so proof against corrosive atmosphere as to protect the ends of the cables and the working parts of the switch against damage.

A switch of an entirely novel design is now being marketed by the ST. HELENS CABLE & RUBBER CO., LTD., of Warrington, for use in connection with their well-known C.T.S. wiring system in corrosive situations. This switch (fig. 2) consists of an outer box of cast-iron containing an ebonite bell-shaped cover, inside which is mounted an ordinary 5-A tumbler switch in an upside-down position. This means that instead of the switch being operated by moving a dolly or other lever handle, the circuit is made or broken by moving the switch itself (under the ebonite bell), whilst the dolly is fixed to the bottom of the outer box. When the switch is wired up and fixed in position a quantity of special sealing compound is poured into the box (to a height regulated by an overflow hole in the latter) which has the effect of forming an air-lock in the upper part of the ebonite cover and completely isolating the vital parts from the outer corrosive atmosphere.

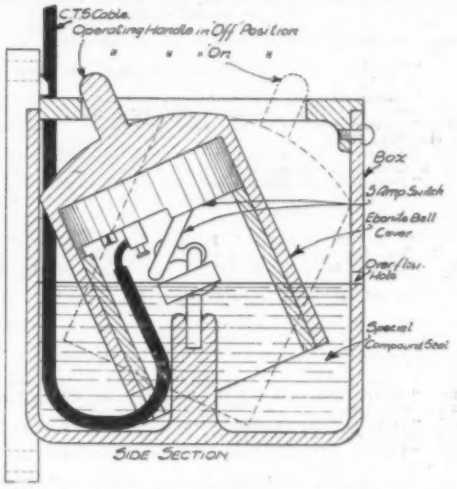

FIG. 2.—ST. HELENS CORROSION-PROOF SWITCH.

The switch is very strongly constructed to withstand the hard usage often encountered in the positions for which it has been devised, and this fixture, in conjunction with the soundness of the design, would appear to make it extremely suitable.

A New Wiring System.

We have received from MESSRS. FAULKNER & CO., 5, Market Street, Manchester, particulars of their Woods's wiring system for lead-covered cables. The system consists of 2-, 3-, and 4-way soft metal bonds for fixing behind ceiling roses or switches, and for junctions a neat cast aluminium box is made in 3 and 4 ways. The main feature of the bonding is that no screws or clips are used and, when fixed to awkward positions like ceilings, it reduces the time required for fixing, which is a great consideration. Its simplicity should commend it to all who are engaged on contracting for the new houses under the housing schemes.

A Bedside Tea Table.

Furniture designed especially to bear or contain domestic electrical appliances is too rarely seen having regard to the position electricity has attained. It is an inherent quality of electricity that it can be used with safety in all sorts of positions, it gives off no fumes, and is essentially clean.

With these points in mind it is pleasing to hear of a tea table for use in a bedroom. This piece of furniture is made by THE CHARMENT CO., LTD., Bank Chambers, 109-111, New Oxford Street, W.C.1. It is a beautiful example of cabinet making, and is constructed in mahogany or oak. The front and top are hinged, and the top is supported by closing-in struts. The base of the inside is of white vitreous material, and the sides bear hooks upon which cups may be hung. At the back of the cabinet is a tin-lined box, in which biscuits may be kept. The table is connected up to a lamp holder or wall plug by flex, which is led into a switch underneath the cabinet and therefore invisible. A kettle, toaster, or other appliance may be placed inside, and the whole when closed up is of very attractive appearance.

Electrical Installations in the United States.—*Electrical Merchandising* gives some interesting statistics relating to lighting installations in the U.S.A., from which we extract the following :—

Total number of residences	20,481,700
Residences using electric light in 1920	6,517,600
Residences using electric light in 1925 (estimated)	10,170,000
Business premises using electrical apparatus in 1920	1,675,900
Business premises using electrical apparatus in 1925 (estimated)	2,600,000
Number of farms in U.S.A.	6,362,502
Farms which are now using electric light and power	340,000
Number of electricity supply stations in the U.S.A.	5 726

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,681. "Primary and secondary batteries." J. T. Niblett. May 17th.
13,682. "Means for regulating current for electric welding apparatus." A. C. Giles and Shipley Tank Co., Ltd. May 17th.
13,714. "Electric controlling devices." M. Walker. May 17th.
13,730. "Apparatus for heating forgings, &c., by electricity." Dagobert Timar & Co. May 17th. (Germany, December 22nd, 1920.)
13,731. "Electric rivet heaters." E. Schröder. May 17th.
13,761. "Electric energy control systems." H. J. Brearey. May 17th.
13,762. "Electric liquid-heating appliances." E. Richter. May 17th.
13,774. "Electric lighting of vehicles, &c." H. C. Crews. May 17th.
13,794. "Magnetic material for loading telephone and telegraph conductors." Western Electric Co., Ltd. (Western Electric Co., Inc.). May 17th.
13,804. "Electrically-controlled locks." H. France and E. G. Mitchell. May 17th.
13,809. "Stranded cables." R. W. Midgley, Sir C. A. Parsons, and J. Rosen. May 17th.
13,815. "Connecting additional transformers to a supply circuit." Siemens-Schuckertwerke. May 17th. (Germany, May 14th, 1920.)
13,816. "Vacuum rectifiers." Siemens-Schuckertwerke. May 17th. (Germany, May 15th, 1920.)
13,824. "Apparatus for starting synchronised non-synchronous motors." Compagnie Générale Electrique. May 17th. (France, October 6th, 1920.)
13,825. "Methods for parallel coupling of generators of polyphase current." Compagnie Générale Electrique. May 17th. (France, October 6th, 1920.)
13,831. "Automatic exchange telephone system." H. Baron (F. Aldendorff). May 17th.
13,865. "Transformer windings." F. Haberle and Sachsenwerk-Licht-und Kraft Akt.-Ges. May 17th. (Germany, May 25th, 1920.)
13,866. "Electric locomotives." W. S. Mundle and R. L. Stanbrook. May 17th.
13,877. "Telephone automatic burglar and fire alarm." T. H. White. May 18th.
13,900. "Variable vibratory contact devices for electric circuits." G. P. Ferreira and J. R. Quain. May 18th.
13,910. "Electric heating-elements." J. J. J. M. Kluijtmans and Phi-Kappa Syndicate, Ltd. May 18th.
13,932. "Indicator for electric circuits." J. Atkins. May 18th.
13,936. "Electric generators." J. R. Middleton and Watts, Williams and Co., Ltd. May 18th.
13,952. "Signal-receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). May 18th.
13,953. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). May 18th.
13,954. "Commutators for dynamo-electric machines, &c." H. J. Curtis. May 18th.
13,958. "Electric bell pushes, &c." G. Wallace. May 18th.
13,961. "Electric butt-welding and tubing produced thereby." A. E. White (Elyria Iron & Steel Co.). May 18th.
13,971. "Means for limiting change of speed in alternating-current generators." T. F. Wall. May 18th.
13,977. "Thermionic devices." H. J. Round. May 18th.
13,997. "Chains for electroliers, &c." T. Hollis. May 19th.
14,029. "Electrical resistances." J. S. Stone. May 19th.
14,040. "Telephone transmitter mouth-pieces." L. van Rutten and Western Electric Co., Ltd. May 19th.
14,042. "Sparking plugs." H. A. Hands and J. Ward. May 19th.
14,052. "Thermionic valves for wireless signalling, &c." H. St. J. de A. Donisthorpe. May 19th.
14,060. "Single-phase short-circuited motors." P. R. Elnegaard. May 19th.
14,063. "Amplifying systems." British Thomson-Houston Co., Ltd. (General Electric Co.). May 19th.
14,065. "Means for ploughing with electric tractor." P. Roulph. May 19th.
14,066. "Protective devices for electric circuits." Metropolitan-Vickers Electrical Co., Ltd. May 19th. (United States, June 9th, 1920.)
14,067. "Thermal relays." Metropolitan-Vickers Electrical Co., Ltd. May 19th. (United States, June 9th, 1920.)
14,079. "Submarine, &c., electric cables." H. W. Sullivan. May 19th.
14,085. "Electric switches." H. C. Gover. May 20th.
14,143. "Electron-discharge apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). May 20th.
14,144. "Incandescent electric lamps, &c." O. Oberlander. May 20th.
14,149. "Regeneration of spent electrical dry cells." H. E. Coley and W. H. Frampton. May 20th.
14,151. "Electric current regulating devices." W. H. Glaser and W. H. Glaser, Ltd. May 20th.
14,163. "Means for regulating speed of electrical machines." Ges fur Drahtlose Telegraphie. May 20th. (Germany, August 9th, 1920.)
14,194. "Miners' electric hand lamps." A. E. Angold and A. H. Railing. May 21st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

17,768. "Measuring of continuous electric current." Bessg. August 20th, 1913.

1916.

5,524. "Arc light electrode with capillary passages." Planiawerke Akt.-Ges. fur Kohlen-Fabrikation. September 13th, 1915. (Addition to 16,364/15.) (101,471.)

1919.

23,722. "Incandescent electric lamps." L. A. de Becker. September 26th, 1919. (162,686.)
24,582. "Electric switches particularly applicable to alarm circuits." T. B. Harris. October 8th, 1919. (162,689.)
26,698. "Vacuum tubes." Siemens & Halske Aktiengesellschaft. October 30th, 1919. (Germany, June 21st, 1916.) (134,542.)
28,706. "Electricity meters." W. Lawson. November 19th, 1919. (162,702.)
30,062. "Windings of alternating current dynamo-electric machines." British Thomson-Houston Co., Ltd., F. H. Clough, and H. W. Taylor. December 2nd, 1919. (162,707.)
30,161. "Thermionic devices for use as amplifiers, relays, detectors, and the like." J. Scott-Taggart. December 3rd, 1919. (162,710.)
30,295. "Block thermo-insulation material." T. B. Munroe. April 3rd, 1919. (141,322.)
30,604. "Ignition devices for internal combustion engines." Telegraph Condenser Co., Ltd., and W. J. Cole. December 6th, 1919. (162,711.)
32,450. "Electric heaters." L. M. Waterhouse, Simplex Conduits, Ltd., and H. F. McLoughlin. December 29th, 1919. (162,715.)
32,523. "Electro-magnetic impulse mechanism." C. L. Walker. December 29th, 1919. (162,716.)
32,532. "Dynamo-electric power plant." M. Harris. December 29th, 1919. (162,717.)

1920.

244. "Electro-magnetic devices for controlling alternating-current dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. January 3rd, 1920. (162,731.)
385. "Anti-vibrators for incandescent electric lamps." E. Booth and N. R. Booth. January 6th, 1920. (162,735.)
1,541. "Electric heating element." H. J. Dean-Osgood. January 17th, 1920. (162,737.)
2,139. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. Savin. January 23rd, 1920. (162,739.)
2,305. "Apparatus for protecting metal-vapour rectifiers." Gleichrichter Akt.-Ges. March 3rd, 1919. (139,756.)
2,850. "Inter-communication or like telephones." W. Stott and Telephone Manufacturing Co. (1920), Ltd. January 29th, 1920. (162,748.)
2,931. "Protective devices for alternating-current electric supply systems." Siemens-Schuckertwerke Ges. November 26th, 1918. (138,367.)
2,957. "Electrical systems of power transmission and regenerative braking." British Thomson-Houston Co., Ltd. (General Electric Co.). January 30th, 1920. (162,755.)
3,068. "Wireless transmitters." W. T. Ditcham. January 31st, 1920. (162,761.)
3,069. "Wireless transmitters." W. T. Ditcham. January 31st, 1920. (162,762.)
3,081. "Cooling arrangements for dynamo-electrical machinery." Siemens-Schuckertwerke Ges. October 7th, 1918. (138,613.)
3,218. "Reception of continuous waves in wireless telegraphy." A. K. Macrorie and W. A. Appleton. February 2nd, 1920. (162,770.)
3,222. "Low-frequency amplification in electrical circuits for use in wireless telegraphy and telephony." A. K. Macrorie and S. H. Long. February 2nd, 1920. (162,771.)
3,223. "Holders for electric valves used in wireless telegraphy." A. K. Macrorie and H. Morris-Airey. February 2nd, 1920. (162,772.)
3,224. "Thermionic valves and their circuits for use in wireless telegraphy and telephony." A. K. Macrorie and H. Morris-Airey. February 2nd, 1920. (162,773.)
3,307. "Electrically-driven machines." E. H. Harman and E. Le Bas. February 3rd, 1920. (162,777.)
3,358. "Transmitters for wireless telephony." A. K. Macrorie and G. A. Irving. February 3rd, 1920. (162,781.)
3,462. "Microphones." A. G. T. Cusins, W. S. Tucker, and E. T. Paris. February 4th, 1920. (162,791.)
3,498. "Electrical transformer arrangements." F. E. Berry. February 4th, 1920. (162,794.)
3,590. "Ignition systems for internal-combustion engines." Dayton Engineering Laboratories Co. November 11th, 1918. (138,646.)
3,627. "Electric couplings for sparking plugs and the like." J. E. Barrows. February 6th, 1920. (Cognate application 8,518/20.) (162,804.)
3,776. "Means for connecting electric light and power cables with junction boxes, distribution boxes, and the like." R. S. Wood. February 7th, 1920. (162,814.)
4,085. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). February 10th, 1920. (162,820.)
4,411. "Protective arrangement for electric distribution and transmission systems." Callender's Cable & Construction Co., Ltd., and P. V. Hunter. February 13th, 1920. (162,828.)
4,640. "Electrical switches." Midland Electric Manufacturing Co., Ltd., and H. E. Sutherland. February 16th, 1920. (162,83?.)
4,661. "Electric lighting of motor cycle combinations." S. G. Muir. February 16th, 1920. (162,834.)
4,715. "Electric transformers." Hackbridge Cable Co., Ltd., and W. C. Kennett. February 16th, 1920. (162,836.)
5,127. "Sparking plugs for internal combustion engines." M. MacGregor. February 20th, 1920. (162,841.)
5,619. "Electric lamps." Efandem Co., Ltd., and A. H. Williams. February 25th, 1920. (162,848.)
6,082. "Electric switches." R. K. Damey and C. A. Damey. February 28th, 1920. (162,858.)
6,661. "Sparking plugs for internal-combustion engines." B. Hopps and A. M. Lodge. March 4th, 1920. (162,868.)
7,517. "Ignition devices for internal-combustion engines and the like." W. Pickard and D. R. Dobson. March 13th, 1920. (162,879.)
7,737. "Sparking plugs." G. Calvert. March 15th, 1920. (Cognate application No. 24,675/20.) (162,880.)
8,692. "Vehicular lamps, searchlights, and other lamps." V. F. Feeny (Wood Corporation). March 24th, 1920. (162,889.)
10,835. "Tungsten alloys particularly for electric lamp filaments." British Thomson-Houston Co., Ltd. (General Electric Co.). April 19th, 1920. (162,907.)
12,029. "Electric heating appliances." Thermos Akt.-Ges. December 5th, 1914. (142,506.)
12,104. "Electric power transmission systems." E. M. Fraser. September 19th, 1919. (151,580.)
12,549. "Protective apparatus for alternating current systems." A. H. Railing, C. C. Garrard, and A. E. McColl. May 6th, 1920. (162,919.)
12,599. "Method of driving electric centrifugal machines having mechanical unloaders." W. Hunt (S. S. Hepworth Co. and E. M. Mackintosh). May 6th, 1920. (162,920.)
13,212. "Glass reflecting globe for electric safety or similar lamps." A. G. Gullifrod. May 13th, 1920. (162,925.)
13,359. "Electric switches." E. T. R. Murray and G. F. Shotter. May 14th, 1919. (143,263.)
13,410. "Electric lanterns or the like." Veritys, Ltd., and F. W. Thorpe. May 15th, 1920. (162,926.)
13,671. "Manufacture and production of a material suitable for use as an insulator for electrical purposes." H. Herrmann. November 7th, 1919. (153,884.)
13,841. "Trunk circuits more particularly for automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 18th, 1919. (151,237.)
14,357. "Sound amplifier." P. R. Gonsky. May 26th, 1920. (162,939.)
15,180. "Electrically-operated indicator or annunciator apparatus." Siemens Bros. & Co., Ltd., and L. de M. G. Ferreira. June 4th, 1920. (162,949.)
16,095. "Radio transmitters." Marconi's Wireless Telegraph Co., Ltd. June 14th, 1919. (145,040.)
16,747. "Electrical distribution and power transmission systems." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). June 21st, 1920. (162,961.)
17,591. "Thermally-controlled electric circuit interrupters." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). June 28th, 1920. (162,965.)
17,611. "Sparking plugs for internal-combustion engines." Soc. H. Trentelivres et Cie. May 29th, 1914. (146,262.)
17,843. "Electric generators." J. W. Torrance and J. M. Torrance. June 30th, 1920. (162,966.)
19,166. "Apparatus for the electrical long-distance control of the valve gear of a hydraulic gun-pointing gear." F. Krupp Akt.-Ges. December 4th, 1916. (Addition to 147,126.) (147,127.)
19,528. "Automatic starters for electric motors." F. Krupp Akt.-Ges. May 5th, 1919. (147,591.)
19,757. "Electrical high-frequency current transformers." Ges fur Drahtlose Telegraphie. July 29th, 1915. (147,754.)
22,383. "Electric light sconce fittings." S. W. Hamlyn. July 27th, 1920. (162,980.)
22,563. "Electro-magnetically operated controlling devices." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). July 29th, 1920. (162,981.)
24,942. "Means for operating constant voltage circuits from variable-speed dynamos." Edison Accumulators, Ltd., and J. F. Monnot. August 28th, 1920. (162,992.)
29,952. "Sparking plugs." C. Chollet and G. Lepape. October 22nd, 1919. (152,968.)
34,903. "Mercury switches for electrical apparatus." K. Kaisser. December 15th, 1919. (155,266.)